

ALTEK

# Process Calibrators



FREQUENCY  
OUTPUT  
DEVICE

ALTEK INDUSTRIES CORP  
LOOP CALIBRATOR  
ALTEK MODEL 334

POWER 2 WIRE  
TRANSMITTERS  
SOURCE

2 WIRE  
TRANSMITTER  
SIMULATOR

ADJUST  
mA - %

4.00 mA  
0.0%

ADJUST FULLY  
CLOCKWISE TO  
POWER 2 WIRE  
TRANSMITTERS

NY 14623 USA

Altek process calibrators are accurate, rugged, and easy to use. . . perfect for control room, shop, or field. They save you time on startups and routine calibration, reduce downtime and increase productivity. Simply select, connect, and check.

Each calibrator does a specific job. Check milliamp loops; simulate and measure thermocouples or RTDs; adjust flowmeters; re-span and zero transmitters with speed and confidence. Built-in QUIK-CHEK™ function lets you switch select zero and full scale. QUIK-CHEK values are stored in memory. . . use the same settings after lunch, the next day, even the next month!

Choose from dozens of standard ranges to cover your plant's milliamp, voltage, thermocouple, RTD, and frequency signals. This catalog gives you the information, including ranges and specifications, for each calibrator. Select the models you need, call or fax your order, and soon you can check every instrument in your plant. In a hurry or need more information; call or fax for the stocking location nearest you.

- High accuracy, NIST (NBS) traceability accuracies from 0.1% to 0.0008%
- Standard alkaline batteries last months, are easy to change, eliminate "waiting for the batteries to recharge"
- Toolbox Tough
- Three-year warranty

---

Data Sheets are in the following order

**QUIK-PAK™**                      5 Different Multi-calibrator combinations

**MILLIAMP**    334    Milliamp Loop Calibrator  
                  234    Milliamp Signal Analyzer  
                  134, 46, 131, 156  
                         Milliamp Simulators/Sources

**VOLTAGE**    235    Process Voltage Analyzer  
                  135    D/C Millivolt/Voltage Source

**THERMOCOUPLE**    422    Universal Type T/C Calibrator  
                          322    Multiple Type T/C Calibrator  
                          222    Thermocouple Calibrator  
                          22    Thermocouple Source

**RTD**            211    RTD Calibrator  
                     11    RTD Simulator

**FREQUENCY**    241    Frequency Calibrator  
                     40A    Frequency Source

**PRESSURE**    620    Precision Pressure Indicator  
                     628    Pressure Pump

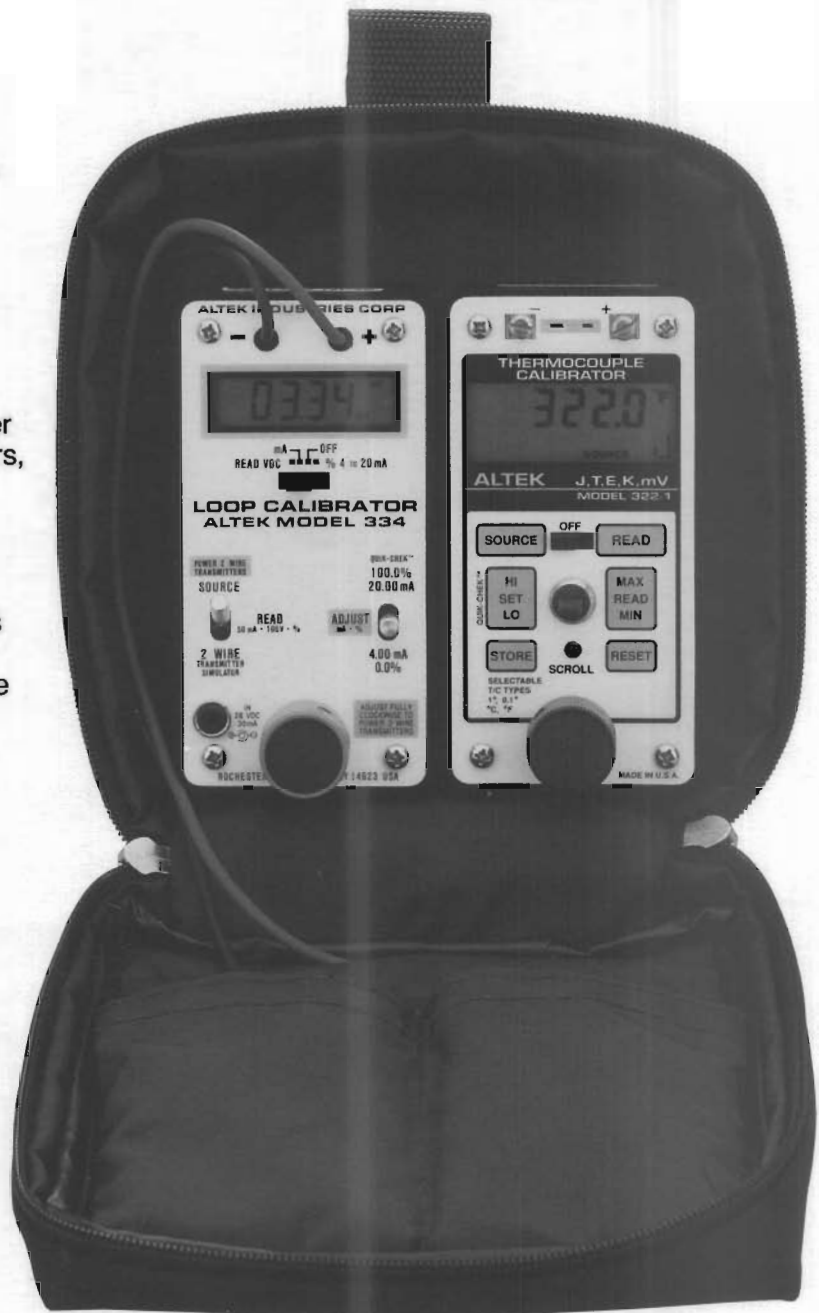
### NEW!

Our new QUIK-PAK kits are designed for virtually any electronic process signal, temperature, frequency, or milliamp flow application. Bench-top accuracy with field portability, these lightweight, self-contained calibration labs allow you to check out more instruments in less time—affordably.

Calibrate instruments and systems, check transmitters, controllers, computer systems, dataloggers, turbine flowmeters, plus final control elements.

Choose from five application-specific Paks. Each contains two hand-held precise calibrators which source, simulate and read signals plus ALTEK's unique QUIK-CHEK™ for instant selection of zero and full scale. All kits include three-year warranty, NIST-traceable certificates, soft-sided carrying case with belt loop, and easily replaceable batteries.

For detailed information on the QUIK-PAKs and your nearest stocking location, call 716-334-3720 or fax 716-334-6673.



- High Accuracy
- Precision Digital Displays
- NIST Traceable
- QUIK-CHEK Function
- Portable, Battery Powered

#### Calibrate and check out:

- RTD and Milliamp Instruments with Pak #545—Models 211 and 334
- Milliamp and Voltage Devices with Pak #569—Models 334 and 235
- T/C and RTD Temperature Measuring Devices with Pak #533—Models 322 and 211
- T/C and Milliamp Instruments with Pak #556—Models 322 and 334
- Frequency and Milliamp Flow Signals with Pak #575—Models 241 and 334

# MILLIAMP LOOP CALIBRATOR MODEL 334

## • ALL 4 TO 20mA LOOP FUNCTIONS

Source 0.00 to 24.00mA or -25.0 to 125.0%  
Read mA or Percent to 52.00mA  
Simulate 2-Wire Transmitters  
Measure -99.99 to 99.99 DC Volts  
Power and Read 2-Wire Transmitters

## • "QUIK-CHEK"™ SWITCH

Instant Zero and Span at 4.00 & 20.00mA

## • FULL 4 DIGIT ACCURACY

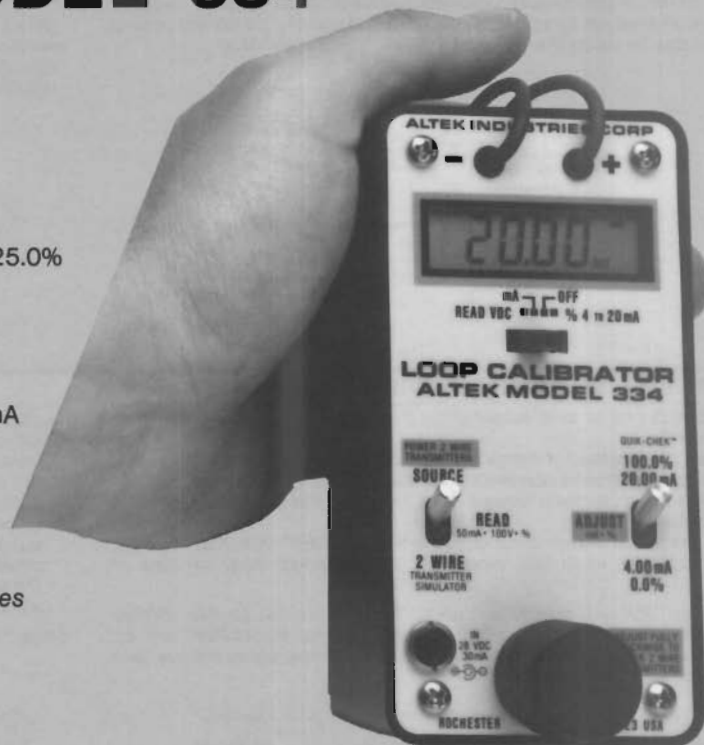
±0.05% of 20.00mA Span  
±0.03% "QUIK-CHEK"

## • STANDARD 9 VOLT BATTERIES

Months of use, no nightly recharging

## • OVERLOAD PROTECTED

Withstands 135 Volts AC/DC *without fuses*



Altek's Model 334 Loop Calibrator has been designed to check, calibrate and trouble shoot all the signals present within a standard 4 to 20 milliamp process control loop. A 24mA Source, mA meter, 2-Wire Transmitter Simulator and a DC Volt meter are combined into one easy-to-operate instrument.

Dual current ranges allow display of each current function in percent of 4 to 20mA signal, as well as directly in milliamps. In SOURCE MODE, percent range displays -25.0% to +125.0% with 0.1% resolution while the milliamp range displays from 0.00 to 24.00mA with 10µA resolution. In READ MODE the milliamp range displays from 0.00mA to 52.00mA, or percent.

SOURCE MODE uses built in batteries to provide 0.00 to 24.00mA into any load from 0 to 1200. Three 9 volt alkaline batteries provide over 30 hours of continuous 12 mA output... more than 3 months of typical use. An optional AC adaptor plugs in for continuous bench use. True current source maintains set output independent of load, "QUIK-CHEK" switch provides instant zero (4.00mA) and full scale (20.00mA) in both SOURCE and 2 WIRE modes. Output in the PERCENT range displays 0.0% and 100.0% for "QUIK-CHEK" settings. ADJUST position selects a continuously adjustable 10 turn potentiometer to allow fast, easy setting to any exact value from 0.00 to 24.00mA. No range change at critical 20.00mA eliminates hysteresis error.

POWER & MEASURE 2-Wire Transmitters simultaneously in Source Mode. The Model 334 supplies the required voltage and displays the current as regulated by the 2-Wire Transmitter.

The Model 334 may also be used when a controller is temporarily removed for repair or replacement. Simply substitute the Model 334 for the controller and use it as a manual loading station.

SIMULATE 2-WIRE TRANSMITTERS by modulating external power to pass 4 to 20mA. The Altek Model 334 uses any loop power from 2 to 100 Volts DC. True current design maintains set current independent of voltage or load changes.

READ MILLIAMPS OR PERCENT of the 4 to 20mA signal. Maximum read current is limited to (nominally) 55mA to minimize the possibility of damaging the device to be calibrated.

MEASURE DC Volts range displays from -99.99 to +99.99 VDC with 10mV resolution. Built in voltmeter is used to check loop power supplies, I/V converters, 1 to 5 Volt signals and battery voltages.

The Model 334 is protected in all ranges to 135 Volts AC or DC. Special protective circuitry withstands accidental misconnection in any mode *without fuses*.

Display digits are 0.4" (10.2mm) high for readability from across the room. Non-glare Liquid Crystal Display is readable in any light... even in direct sunlight. The digital measuring circuit is independent of the current adjustment and measures the actual input or output.

Benchtop accuracy in a toolbox calibrator assures fast, precise setting of current trips, recorders, controllers, loggers, computers and final control elements. Altek brings you the handy Model 334 Loop Calibrator at a cost low enough for every bench and toolbox.

## WARRANTY

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from date of shipment. Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option. The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incident or consequential damage.

## OTHER PRODUCTS

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal. Consult our factory directly or your local supplier to order precise, low cost Milliamper, RTD, Thermocouple, Voltage and Frequency Calibrators. Additional models and ranges are frequently added to the Altek instrument family to meet all of your critical calibration requirements.

## ALTEK INDUSTRIES CORP

210 Commerce Drive  
Rochester, New York 14623 U.S.A.  
(716) 334-3720

FAX: (716) 334-6673

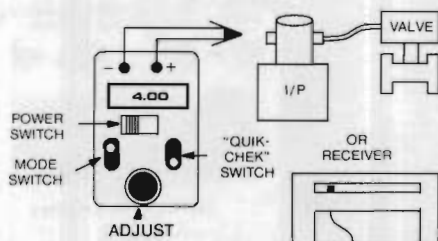


# OPERATING INSTRUCTIONS

## SOURCE MILLIAMPS

- 1) Disconnect one or both input wires from the device to be calibrated
- 2) Connect the red lead of the calibrator to the plus (+) input of the device and the black lead to the minus (-)
- 3) Move the power switch to mA or %

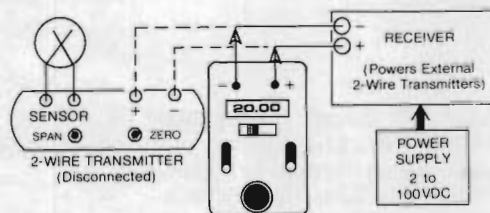
Output current is continuously adjustable with the "QUIK-CHEK" switch in the ADJUST position. Exact 0.0% (4.00mA) and 100.0% (20.00mA) outputs are available by using the 0.0 and 100.0% "QUIK-CHEKs."



## SIMULATE 2-WIRE TRANSMITTERS

- 1) Disconnect existing 2-Wire transmitter from the loop
- 2) Put the Mode selector switch into the 2 WIRE position
- 3) Connect the red lead of the calibrator to the plus (+) terminal of the field connections and the black lead to the minus (-)
- 4) Move the power switch to mA or %

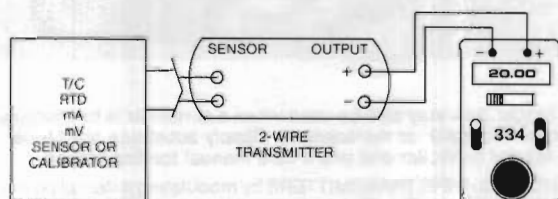
Select the 0.0% (4.00mA) and 100.0% (20.00mA) "QUIK-CHEK" switch positions to quickly calibrate the endpoints of your receivers. Use the ADJUST position and dial to select any value from -25.0 (0.00mA) to 125.0% (24.00mA).



## POWER & MEASURE 2-WIRE TRANSMITTERS

- 1) Disconnect one or both output wires from the 2-Wire Transmitter to be calibrated
- 2) Connect the red lead of the calibrator to the plus (+) and the black lead to the minus (-) power connections of the 2-Wire Transmitter
- 3) Connect an appropriate sensor or calibrator to the input of the 2-Wire Transmitter
- 4) Move the power switch to mA or %, the "QUIK-CHEK" switch to ADJUST, and rotate the knob fully clockwise (see shaded areas on face of unit)

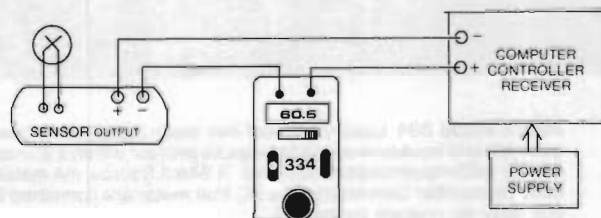
The Model 334 will supply a (nominal) 24 Volts DC to the 2-Wire Transmitter. The milliamp current passed by the transmitter will be accurately displayed. Calibrate the transmitter in the usual manner and disconnect the Model 334.



## READ MILLIAMPS

- 1) Open the current loop at any convenient point along the signal path
- 2) Connect the red lead of the calibrator to the more positive point of the break and the black lead to the more negative
- 3) Put the Mode selector switch into the READ position
- 4) Move the power switch to mA or %. The Model 334 will read current in the loop from 0.00mA to 52.00mA or -25.0% to 300%. Loop current is automatically limited to approximately 55mA to avoid any damage to other devices within the loop. If the Model 334 is accidentally connected in the wrong polarity, the display will read 0.00mA or -25.0% and no current will flow in the loop. Simply reverse the leads for correct operation.

Note: "QUIK-CHEK" switch is disabled when reading

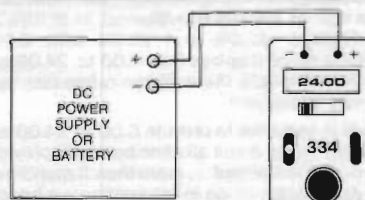


## MEASURE VOLTS DC

- 1) Put the mode switch to READ
- 2) Move the power switch to READ DCV
- 3) Connect the red and black leads across the voltage to be measured

Any DC Voltage from -99.99 to +99.99 Volts may be measured. Loop power supplies, signal voltages at receivers, batteries and transmitter voltage drops may be measured. Signals exceeding  $\pm 100$  VDC will be indicated by OVRLD on the LCD.

Note: "QUIK-CHEK" switch is disabled when reading



## SPECIFICATIONS

(Unless otherwise indicated, specifications are in % of 20mA or 100VDC span at 25°C)

### GENERAL

ACCURACY:  $\pm 0.05\% \pm 1$  least significant digit  
 "QUIK-CHEK", Source & 2-Wire Modes, Accuracy  $\pm 0.03\%$   
 DISPLAY: Liquid Crystal; 4 Digit, 0.4" (10.2mm) high  
 TEMPERATURE EFFECT:  $\pm 0.008\%/^{\circ}\text{C}$   
 BUILT-IN BATTERIES: 3 x 9 Volt Alkaline  
 AC ADAPTORS: Optional, 120 or 240 VAC, 50/60 Hz  
 BATTERY LIFE:

SOURCE MODE: 33 hours at 12mA, 20 hours at 20mA output  
 2-WIRE SIMULATOR or READ MODES: 150 hours

LOW BATTERY INDICATION: BAT indicated on LCD when approximately 1 hour remains driving 12mA into 800 Ohms

OVERVOLTAGE PROTECTION: Protected to 135 Volts AC or DC in all ranges without fuses

OVERLOAD PROTECTION:

SOURCE & 2-WIRE SIMULATOR MODES: Current limited to 25mA  
 READ MODE: Current limited to 55mA

OPERATING AMBIENT TEMPERATURE: -20 to +60°C (-5 to +140°F)

STORAGE TEMPERATURE: -30 to +70°C (-22 to +160°F)

RELATIVE HUMIDITY: 10 to 90%, non-condensing

WARM UP TIME: 3 seconds to rated accuracy

OVERALL SIZE: 2 1/2 x 2 x 5 1/2 inches (63.5 x 66.7 x 130mm)

WEIGHT: 12 oz. (0.35 kg)

### ORDERING INFORMATION

|  | Part No. |
|--|----------|
| MODEL 334: LOOP CALIBRATOR                       | 334-2050 |
| AC Adaptor                                       | 28-0120  |
| AC Adaptor                                       | 28-0240  |
| CARRYING CASE: Optional, zippered with belt loop | 09-3781  |

### SOURCE MODE

RANGES:

0.00 to 24.00mA with 10 $\mu$ A resolution

-25.0 to 125.0% of 4-20mA with 0.1% resolution

TYPICAL DRIVE CAPABILITY: 1200 Ohms with fresh batteries or adaptor, 800 Ohms at low battery indication (BAT)

POWER TO EXTERNAL 2-WIRE TRANSMITTER: Nominal 24 VDC with fresh batteries or adaptor

### READ MODE

RANGES:

0.00 to 52.00mA with 10 $\mu$ A resolution

-25.0 to 300.00% of 4-20mA with 0.1% resolution

-99.99 to 99.99 VDC with 10mV resolution, OVRLD at  $\pm 100$  VDC

INPUT IMPEDANCE: VDC range, >10 Meg Ohms

VOLTAGE BURDEN: 0.8 V at 4.00mA, 1.1 V at 20mA, 1.6 V at 50.00mA

### 2-WIRE TRANSMITTER SIMULATOR MODE

RANGES:

0.00 to 24.00mA with 10 $\mu$ A resolution

-25.0 to 125.0% of 4-20 mA with 0.1% resolution

LOOP VOLTAGE LIMITS: Minimum, 2 VDC; Maximum 100 VDC

AVAILABLE FROM:

# 20 MILLIAMP SIGNAL ANALYZER MODEL 234

## ALTEK

- **TRIPLE FUNCTION, 0 TO 20mA & -25 TO +125%**  
Source, Read & 2-Wire simulate
- **PRECISE 3½ DIGIT LCD**  
±0.1% of 4-20mA SPAN in Milliamps or Percent
- **"QUIK-CHEK™" ZERO AND FULL SCALE**  
Switch 4.00, 20.00mA or Continuous Dial
- **POCKET SIZE & LIGHTWEIGHT**  
12.5 oz. (0.35 kg) with 3 Month Batteries
- **THREE YEAR WARRANTY**  
Tough enough for your Toolbox

ALTEK'S triple function MODEL 234 SIGNAL ANALYZER combines a self contained 0-24mA SOURCE, a 2-WIRE SIMULATOR and a large LCD DIGITAL READOUT in a single pocket sized instrument.

DUAL RANGE allows display of each function in PERCENT of 4-20mA signal, as well as directly in MILLIAMPS. PERCENT range displays minus 25.0% to plus 125.0% with 0.1% resolution. MILLIAMP range displays from 0.00 to 19.99mA with 10 microamp resolution. ACCURACY is ±0.1% of 4-20mA ±½ least significant digit.

"QUIK-CHEK" switch provides instant zero (4.00mA) and full scale (20.00mA) settings in both SOURCE and 2-WIRE modes. Output in the PERCENT range displays 00.0% and 100.0% for "QUIK-CHEK" settings. DIAL position selects a continuously adjustable 10 turn potentiometer to allow fast, easy setting to any exact value.

SOURCE MODE uses built-in batteries to provide 0-24mA into any load from 0-1000 ohms. 3 nine volt alkaline batteries provide over 20 hours of continuous 20mA output... more than three months of typical use. An optional AC adaptor plugs in for continuous bench use. True current source maintains set output independent of load. 2-WIRE TRANSMITTERS can be POWERED and MEASURED in this mode.

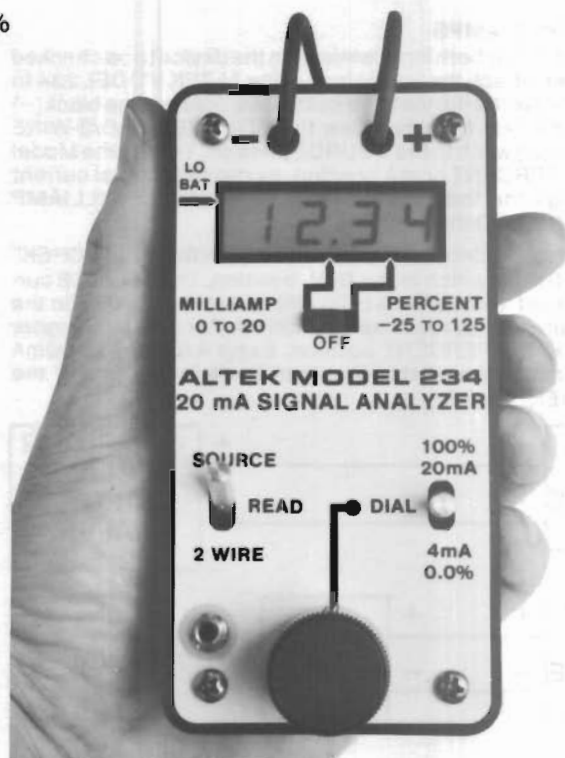
2-WIRE SIMULATOR mode modulates external power to pass 4-20mA. The ALTEK MODEL 234 uses any LOOP POWER from 2 to 100 volts DC. True current design maintains set current independent of voltage or load changes.

READ mode displays either MILLIAMPS or PERCENT of 4-20mA signal. Maximum READ current is limited to (nominally) 25mA to minimize the possibility of damaging the calibrator or the loop to be calibrated. Special protective circuitry withstands accidental misconnection in any mode without fuses.

DISPLAY digits are 0.350" (9mm) high for readability from across the room. Non-glare LIQUID CRYSTAL DISPLAY is readable in any light... even in direct sunlight. The digital measuring circuit is independent of the current adjustment and measures the actual input or output.

The ALTEK MODEL 234 is rugged, yet lightweight and pocket sized. Latest LSI circuitry and wide temperature range components make the Model 234 ideal for use in the field, control room and shop.

BENCHTOP ACCURACY in a TOOLBOX CALIBRATOR assures fast, precise setting of current trips, recorders, controllers, loggers, computers and final control elements. ALTEK brings you the handy MODEL 234 SIGNAL ANALYZER at a cost low enough for every bench and toolbox.



### SPECIFICATIONS ALTEK MODEL 234

(Unless otherwise indicated, specifications are in % of 16mA span)

**ACCURACY:** ±0.1% (±½ least significant digit)

**DISPLAY:** Liquid Crystal; 3½ digit, 0.35" (9.0mm) high

**DISPLAY RANGES:** 0.00 to 19.99mA (-25.0 to +125.0%)

**RESOLUTION:** 0.1% (percent mode) 0.01mA (mA mode)

**READ PROTECTION:** Limited to nominal 25mA against accidental misconnection

**OVERVOLTAGE PROTECTION:** Protected to 120 Volts AC or DC in all ranges without fuses

**TEMPERATURE EFFECT:** ±0.01%/Degree C

**OUTPUT/2-WIRE RANGES:** 0 to 24mA DC (-25 to +125%) continuous

**"QUIK-CHEK" SETTINGS:** 4.00 and 20.00mA (00.0 and 100.0%)

**OUTPUT DRIVE CAPABILITY:** 1000 ohms with fresh batteries or adaptor, 800 ohms at first low battery warning

**BUILT-IN BATTERIES:** 3 x 9 volt alkaline, included

**POWER TO EXTERNAL 2-WIRE TRANSMITTER:** 24 volts with fresh batteries or adaptor

**BATTERY LIFE:** SOURCE; 20 hours at 20mA continuous. READ and 2-WIRE mode; 150 hours

**AC ADAPTORS:** optional; 120 or 240V, 50/60 Hz

**LOW VOLTAGE INDICATORS:** LO BAT ARROW turns on at 18 volts; decimal point turns off at 9 volts

**LOOP VOLTAGE LIMITS:** 2-Wire Simulator Mode; minimum, 2V DC; maximum, 100V DC

**OPERATING AMBIENT TEMPERATURE:** Minus 5 to plus 140 degrees F (minus 20 to plus 60 degrees C)

**STORAGE TEMPERATURE:** Minus 22 to plus 175 degrees F (minus 30 to plus 80 degrees C)

**RELATIVE HUMIDITY:** 10 to 90%, non-condensing

**WARM UP TIME:** 3 seconds to rated accuracy

**OVERALL SIZE:** 2½ x 2½ x 5½ inches (63.5 x 66.7 x 130 mm)

**WEIGHT:** 12.5 oz. (0.35 kg)

**CARRYING CASE:** Optional, zippered with belt loop

### ALTEK INDUSTRIES CORP.

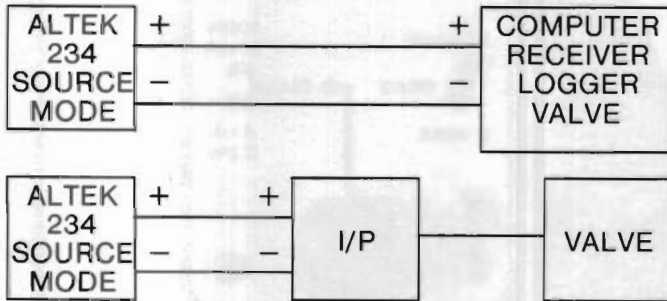
210 Commerce Drive  
Rochester, New York 14623 U.S.A.  
(716) 334-3720  
FAX: (716) 334-6673

# OPERATING INSTRUCTIONS

## SOURCE MILLIAMPS

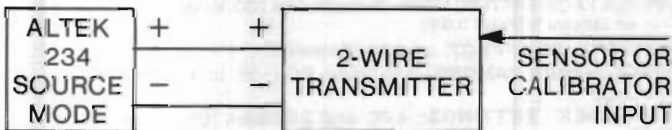
Disconnect one or both input wires from the device to be checked or calibrated. Attach the red (+) lead of the ALTEK MODEL 234 to the plus input of the device to be calibrated, connect the black (-) lead to the minus terminal. Turn the SOURCE/READ/2-WIRE mode selector switch to the SOURCE position. Turn on the Model 234 to the PERCENT or mA position, as desired. Actual current sent through the loop is seen as a PERCENT or MILLIAMPER reading in the LCD display.

Output current is continuously adjustable with the "QUICK-CHEK" (0%/DIAL/100%) switch in the DIAL position. The SOURCE current can be set from 0.00mA (-25.0%) to 24mA (125.0%). In the mA mode, the display reads up to 19.99mA. For display of higher outputs, use the PERCENT position. Exact 4.00 and 20.00mA output is instantly available in either mode by the use of the "QUICK-CHEK" switch.



## POWER & MEASURE 2-WIRE TRANSMITTERS

Connect the Model 234 (+) and (-) leads to the power leads of the 2-wire transmitter to be powered and measured. Connect the appropriate signal to the input of the 2-wire transmitter. Set the "QUICK-CHEK" switch to the DIAL position. Turn the DIAL fully clockwise (maximum position). Set the mode switch to the SOURCE position. Turn the 234 on to either the mA or the PERCENT display modes. 24 volts (nominal) will be supplied to the 2-wire transmitter by the 234. The milliamp current passed by the transmitter will be accurately displayed. Calibrate the 2-wire transmitter in the usual manner and disconnect the 234.



## WARRANTY

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from date of shipment.

Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option.

The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incident or consequential damage.

## ORDERING INFORMATION:

MODEL 234: 20 Milliamp Signal Analyzer  
AC Adaptor: 120V AC  
AC Adaptor: 240V AC  
Carrying Case

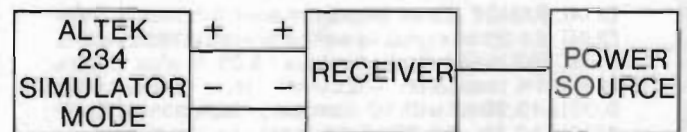
## Part No.

234-0420  
28-0120  
28-0240  
09-3781

## SIMULATE 2-WIRE TRANSMITTERS

Disconnect any existing 2-wire transmitter from the loop to be checked or calibrated. (Only one of the two wires need be disconnected.) Leave the power source and the receiver in place.

Put the mode selector in the 2-WIRE position. Connect the red lead of the ALTEK Model 234 to the plus (+) terminal of the field connections. Connect the black lead to the minus (-) terminal and turn the 234 on. The LCD display will read the loop current in PERCENT or mA, as selected. 0% (4.00mA) DIAL adjustment and 100% (20.00mA) are selected with the right hand "QUICK-CHEK" switch. Instant ZERO and FULL SCALE checks are made with the 0% and 100% positions. The DIAL mode allows continuous adjustment of the 2-wire current from 0.00mA (-25.0%) to 24mA (125%). Complete any necessary recalibration and turn the ALTEK Model 234 off. Reconnect any wires removed for check-out.



## READ MILLIAMPS

Open the current loop at any convenient point along the signal path. Connect the ALTEK Model 234 Red (+) lead to the more positive point of the break. Connect the Black (-) terminal to the more negative side of the break. Put the left hand mode select switch in the "READ" position and turn the unit on in either MILLIAMPER or PERCENT display position. The Model 234 will read current in the loop from 0 to 19.99mA or -25 to +125% (24mA).

LOOP CURRENT is automatically limited to approximately 25mA to avoid any damage to the calibrator or other devices within the loop. If the Model 234 is accidentally connected in the wrong polarity, the display will read 0.00mA or -25.0% and no current will flow in the loop. Simply reverse the leads for correct operation.



## OTHER PRODUCTS

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal. Consult our factory directly or your local supplier to order precise, low cost Milliamp, RTD, Thermocouple, Voltage and Frequency Calibrators. Additional models and ranges are frequently added to the Altek instrument family to meet all of your critical calibration requirements.

## AVAILABLE FROM:



# ALTEK

## MILLIAMPER CALIBRATORS

### Models 46, 131, 134, 156

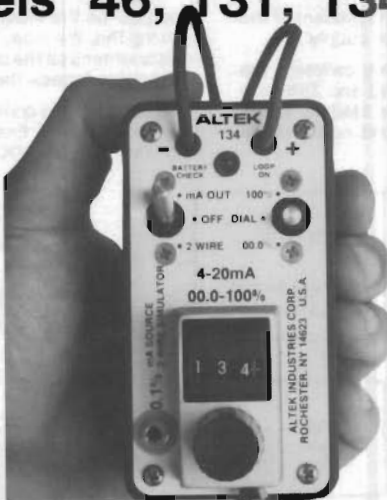


**MODEL 46**

- **2-WIRE SIMULATOR**  
Calibrate Receivers
- **5 POINT CALIBRATION**  
4, 8, 12, 16, 20mA
- **LOOP POWERED**  
No Batteries Required
- **EASY TO USE**  
One Hand Operation

Simulate 2-Wire Transmitters to calibrate receivers, recorders, controllers, indicators and computers. Loop Power eliminates the need for batteries. Loop current is CLAMPED at the key value you select. Accuracy is  $\pm 0.08\%$  of 4 to 20mA, even with changes in load and supply voltage.

Switch settings of 0, 25, 50, 75 and 100% give you fast, full range checkout of instrument or system. The single switch and palm sized case have been designed for simple, one handed operation. Just clip the Built-in leads to the 2-Wire terminals in the Field, Junction Box or Control Room.



**MODEL 134 (156)**

- **MILLIAMPER OUTPUT**  
Sources 4-20mA
- **2-WIRE SIMULATOR**  
Field or Panel
- **"QUIK-CHEK" SWITCH**  
Instant 4.00 & 20.00mA
- **CONTINUOUS DIAL**  
0.02% Resolution

Calibrate computers, receivers and controllers with unparalleled ease. The Model 134 is also ideal for setting current trips and stroking valves. Built-in batteries supply 20mA loads from 0 to 1000 Ohms (typically 3 months of field use).

Simulate any 2-Wire Transmitter without using internal batteries. Current stays at desired value even with changes in load and supply voltage.

"QUIK-CHEK" switch gives you instant settings of 0 and 100% for both the mA Source and 2-Wire Simulator. Set any value in dial position using the 10 turn continuous adjustment.



**MODEL 131**

- **THREE MODELS**  
131-1 0-1mA  
131-10 0-10mA  
131-20 0-20mA
- **BUILT-IN BATTERIES**  
Replaceable 9 Volts
- **"QUIK-CHEK" SWITCH**  
Instant 0 and 100%

True current source design for accurate ( $\pm 0.1\%$ ) calibration. Models for 0 to 1, 0 to 10 or 0 to 20 milliamps give you precisely the range you need, for zero based receivers. Select instant settings of 0 and 100% for Zero and Full Scale Output. Set any exact value using the digital dial.

Continuous adjustability with memory lock assures fast, precise settings of power metering circuits, current trips, recorders, data loggers, controllers, computers and final control elements. Built-in long life batteries allow complete portability for checkout and calibration of all milliamper input devices.

ALTEK'S broad line of pocket sized milliamper calibrators offers 2-Wire transmitter simulators as well as milliamper sources. Each model gives you ease of use, as well as accuracy and ruggedness.

When you check out receivers, recorders or controllers in a 2-Wire 4 to 20mA loop, simply disconnect the 2-Wire transmitter and hook up a Model 46 or 134 in 2-Wire mode. Flip a switch to get instant Full Scale and Zero outputs. The calibrators operate just like a 2-Wire transmitter by modulating the external power supply voltage into a 4 to 20mA signal.

When a zero based milliamper source is needed to simulate power transducers, calibrate meters, excite strain gauges or RTDs; choose one of our Model 131 mA Sources. Each model has a "QUIK-CHEK" switch for Full Scale and Zero, in addition to a continuous digital dial. Lock the dial for precise setting of a third output value. Set it at the midpoint for checking linearity or at any other desired value in the range.

In the control room, shop, or field, use the Model 134 as a precise 4 to 20mA Source. Stroke valves, set trip points or calibrate receivers or recorders. Easily replaceable 9 Volt alkaline batteries will source 20 milliamps continuously for over 25 hours. Many users can go for months between battery changes!

Used as a 2-Wire Transmitter Simulator the Model 134 receives all of its operating power from the loop. This lets you operate continuously for days when long term loop testing is required. Use it as a manual loading station when a controller needs repair or replacement. Minimize process shutdowns installing a new controller.

Model 156 is similar to the Model 134, but operates in 10 to 50mA loops. The digital dial covers 10 to 50 mA with "QUIK-CHEKs" at 0.0 and 100.0%.

High efficiency design typically gives you months of operation before replacing the batteries. Optional AC adaptors are available for full time bench use.

ALTEK is your source for other milliamper analyzers with additional features, plus calibrators for Thermocouple, Voltage, RTD and process Frequency Signals.

Altek also produces calibrators for custom ranges and unique applications. Additional models and ranges are frequently added to the Altek instrument family to meet all of your critical calibration requirements.

**ALTEK INDUSTRIES CORP**  
210 Commerce Drive  
Rochester, New York 14623 U.S.A.  
(716) 334-3720  
FAX: (716) 334-6673



# OPERATING INSTRUCTIONS

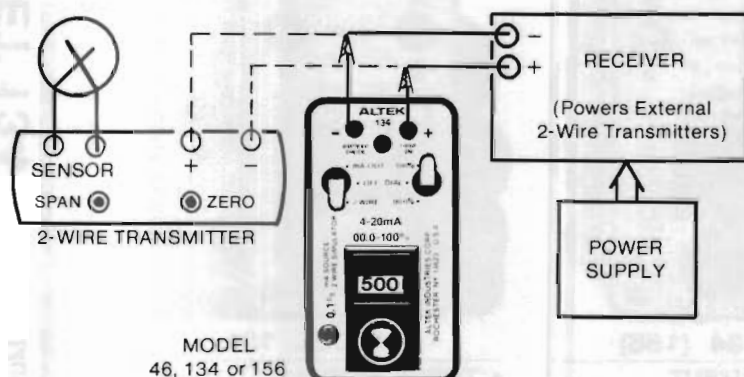
## 2-WIRE SIMULATOR MODE

### Models 46, 134 & 156

- 1) Disconnect existing 2-Wire transmitter from the loop
- 2) Put the Mode selector switch (Models 134 & 156) into the 2-Wire position
- 3) Connect the red lead of the calibrator to the plus (+) terminal of the field connections and the black lead to the minus (-)

The LED will glow steadily to indicate that the loop current is present. If the LED doesn't glow, check the connections and the power supply.

Select the 0.0% and 100.0% switch positions to quickly calibrate the endpoints of your receivers. Intermediate positions of 25, 50 and 75% may be selected with the Model 46. Use the digital dial on the Models 134 & 156 to select any value from 0.0 to 100.0% (a setting of 645 on the dial is equal to 64.5%).



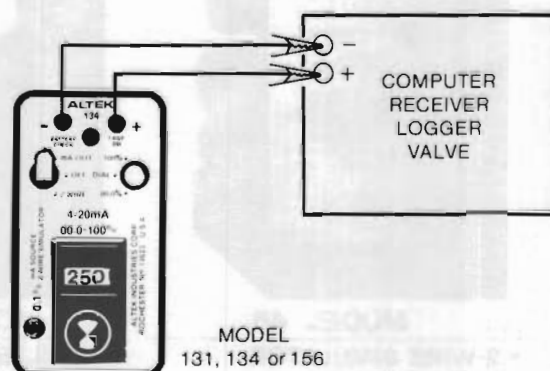
## SOURCE MODE

### Models 131, 134 & 156

- 1) Disconnect one or both wires from the device to be calibrated
- 2) Connect the red lead of the calibrator to the plus (+) input of the device and the black lead to the minus (-)
- 3) Move the Mode switch to ON (Model 131) or mA OUT (Models 134 & 156)

The LED on the Models 134 & 156 will glow steadily only when current is flowing thru the loop. The LED on the Model 131 glows when switched on and brightens as the current increases. If the LED doesn't light or change in brightness, check the batteries and connections.

Output current is continuously adjustable with the "QUIK-CHEK" switch in the DIAL position. Exact 0.0 and 100.0% outputs are available by using the 0.0 and 100.0% "QUIK-CHEKs."



## SPECIFICATIONS

(Unless otherwise specified, specifications are in  $\pm\%$  of Span @ 25 Degrees C)

### ACCURACY:

MODEL 46 ...  $\pm 0.08\%$

MODEL 131 ...  $\pm 0.1\%$

MODELS 134 & 156

Dial:  $\pm 0.1\%$  from 1% to 99%

"QUIK-CHEK" Switch:  $\pm 0.08\%$  at 0.00% and 100.0%

TEMPERATURE EFFECT:  $\pm 0.01\%$ /Degree C

OPERATING TEMPERATURE RANGE:  $-10$  to  $+140^{\circ}\text{F}$  ( $-25$  to  $+60^{\circ}\text{C}$ )

STORAGE TEMPERATURE LIMITS:  $-40$  to  $+160^{\circ}\text{F}$  ( $-40$  to  $+70^{\circ}\text{C}$ )

POWER SUPPLY EFFECT:  $\pm 0.005\%$ /Volt

WARM UP TIME: 2 Seconds to rated accuracy

### WEIGHT:

Model 46 ... 3 ounces (85 grams)

Models 131, 134 & 156 ... 12 ounces (340 grams)

### SIZE:

Model 46 ...  $1\frac{1}{2} \times 2\frac{1}{4} \times 3\frac{1}{4}$  inches (38x54x63 mm)

Models 131, 134 & 156 ...  $2\frac{1}{4} \times 4 \times 2\frac{1}{4}$  inches (54x102x55 mm)

### LOOP VOLTAGE LIMITS:

Models 46 & 134 ... 6 to 45 VDC

Model 156 ... 45 to 90 VDC

### OUTPUT DRIVE CAPABILITY:

| Model        | Fresh Batteries or AC Adaptor | Battery Low Limit |
|--------------|-------------------------------|-------------------|
| 131-1        | 14k Ohms                      | 10k Ohms          |
| 131-10       | 1400 Ohms                     | 1k Ohms           |
| 131-20 & 134 | 1000 Ohms                     | 800 Ohms          |
| 156          | 350 Ohms                      | 275 Ohms          |

### BATTERY LIFE: (Nominal):

| Model  | Nominal Life- Alkaline Battery (Recommend Duracell mN 1604) |            |
|--------|---|------------|
| 134    | 25 hours at 20mA continuous output                          | (3-9 Volt) |
| 156    | 8 hours at 50mA continuous output                           | (3-9 Volt) |
| 131-1  | 500 hours at 1mA continuous output                          | (2-9 Volt) |
| 131-10 | 50 hours at 10mA continuous output                          | (2-9 Volt) |
| 131-20 | 25 hours at 20mA continuous output                          | (3-9 Volt) |

### Battery Check:

Model 131 ... LED will glow when the power switch is held in the BATTERY CHECK position

Models 134 & 156 ... LED will pulse once when the power switch is moved to the mA OUT position

## DIGITAL DIAL SETTING vs MILLIAMPS

| MODEL                          | Reading on Dial |        |      |      |      |      |      |      |        |      | Clockwise ♦ |      |      |      |      |
|--------------------------------|-----------------|--------|------|------|------|------|------|------|--------|------|-------------|------|------|------|------|
|                                | 000             | 062(5) | 100  | 200  | 250  | 300  | 400  | 500  | 562(5) | 600  | 700         | 750  | 800  | 900  | 000  |
| 134 (LINEAR)                   | 4.00            | 5.00   | 5.60 | 7.20 | 8.00 | 8.80 | 10.4 | 12.0 | 13.0   | 13.6 | 15.2        | 16.0 | 16.8 | 18.4 | 20.0 |
| (0, 25, 50, 75, 100% D/P FLOW) | 0%              | 25%    |      |      | 50%  |      |      |      | 75%    |      |             |      |      |      | 100% |
| 156 (LINEAR)                   | 10.0            | 12.5   | 14.0 | 18.0 | 20.0 | 22.0 | 26.0 | 30.0 | 32.5   | 34.0 | 38.0        | 40.0 | 42.0 | 46.0 | 50.0 |
| 131-1                          | 00.0            |        | .100 | .200 | .250 | .300 | .400 | .500 |        | .600 | .700        | .750 | .800 | .900 | 1.00 |
| 131-10                         | 00.0            |        | 1.00 | 2.00 | 2.50 | 3.00 | 4.00 | 5.00 |        | 6.00 | 7.00        | 7.50 | 8.00 | 9.00 | 10.0 |
| 131-20                         | 00.0            |        | 2.00 | 4.00 | 5.00 | 6.00 | 8.00 | 10.0 |        | 12.0 | 14.0        | 15.0 | 16.0 | 18.0 | 20.0 |

MILLIAMPS

## ORDERING INFORMATION:

|  | Part No. |
|--|----------|
| Model 46 2-Wire Transmitter Simulator        | 46-0420  |
| Model 131 0 to 1mA Source                    | 131-1    |
| 0 to 10mA Source                             | 131-10   |
| 0 to 20mA Source                             | 131-20   |
| Model 134 4 to 20mA Source/2-Wire Simulator  | 134-0420 |
| Model 156 10 to 50mA Source/2-Wire Simulator | 156-1050 |
| AC Adaptors for Models 131, 134 & 156        |          |
| 120 VAC Adaptor                              | 28-0120  |
| 240 VAC Adaptor                              | 28-0240  |
| Carrying Case                                | 09-3781  |

## WARRANTY

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from date of shipment. Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incident or consequential damage.

## AVAILABLE FROM:

# PROCESS VOLTAGE ANALYZER MODEL 235

## ALTEK

- **VOLTS - 3 WAY**  
Voltage Source  
Voltage Sink  
Voltage Read
- **THREE RANGES**  
0 to 100mV  
0 to 10V  
0 to 100% (1 to 5V)
- **LOW OUTPUT IMPEDANCE**  
0.3 Ohms or less
- **"QUICK-CHEK" SWITCH**  
User adjustable HI and LO  
Plus Continuous Dial
- **OVERLOAD PROTECTION**  
Withstands 120V AC or DC

ALTEK'S triple function MODEL 235 PROCESS VOLTAGE ANALYZER combines a self-contained DC VOLTAGE SOURCE, a VOLTAGE SINK and a large LCD DIGITAL VOLTAGE READOUT in a pocket sized instrument.

THREE RANGES provide 0.1% resolution from 0 to 100mV, 0 to 10V and 0 to 100% (of 1 to 5). 100% OVERANGE CAPABILITY allows signals up to 200mV or 20V to be sourced or read.

SOURCE MODE uses built-in batteries to calibrate high or low impedance voltage or millivolt instruments. Accuracy is maintained to devices requiring up to 30mA. Three nine volt alkaline batteries provide 100 hours of use into high impedance loads. An optional AC adaptor plugs in for continuous bench use.

User adjustable QUICK-CHEK switch provides instant HI and LO settings in SOURCE MODE. DIAL position selects a continuously adjustable potentiometer. Full 10 turns with high resolution allows fast, easy setting to any exact value.

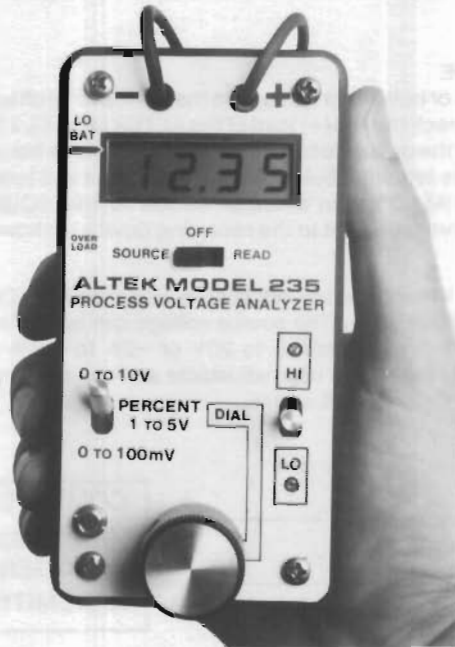
SINK MODE operates automatically in Source position to allow calibration of live circuits without disconnecting wires. Circuit sinks up to 20mA to clamp test voltage in all ranges. 1 to 5 Volt devices in live 4 to 20mA loops can be calibrated without any effect on the other instruments in the loop.

READ MODE provides precise indication of both positive and negative voltages in the 100mV and 10V ranges. 0 to 100% is displayed in the 1 to 5 Volt range for checkout of process control instruments. High input resistance (>2 Megohms) minimizes loading effect on signals. Special protective circuitry withstands misconnection to 120V AC in any mode without fuses.

DISPLAY digits are 0.35" (9mm) high for readability from across the room. Non-glare LIQUID CRYSTAL DISPLAY is readable in any light . . . even in direct sunlight. The digital measuring circuit is independent and measures the actual input or output.

The ALTEK MODEL 235 is rugged, yet lightweight and pocket sized. Backed by a three year warranty, the Model 235 is toolbox tough. Latest LSI circuitry and wide temperature range components make the Model 235 ideal for use in the field, control room and shop.

BENCHTOP ACCURACY in a TOOLBOX CALIBRATOR assures fast, precise setting of trips, recorders, controllers, loggers, computers and analysis instruments. ALTEK brings you the handy MODEL 235 PROCESS VOLTAGE ANALYZER at a cost low enough for every check-out and maintenance person.



### SPECIFICATIONS ALTEK MODEL 235

(Unless otherwise indicated, specifications are in % of Span at 25°C)

**ACCURACY:**  $\pm(0.1\% + 1 \text{ least significant digit})$

**DISPLAY:** Liquid Crystal; 3½ digit, 0.35" (9.0mm) high

**NEGATIVE VOLTAGES:** Measured on 100mV and 10V ranges

"QUICK-CHEK" Factory preset at 0% and 100% (1 and 5V)

| ADJUSTMENT RANGE | LO             | HI            |
|------------------|----------------|---------------|
| 10V              | -0.1V to +1.5V | 0.75V to 11V  |
| 0 - 100%         | -25% to +12%   | -10% to 199%  |
| 100mV            | -4mV to +25mV  | 10mV to 199mV |

**BUILT-IN BATTERIES:** 3 × 9 Volt alkaline are included

**BATTERY LIFE:** 100 Hours, Sourcing into high impedance loads; 20 Hours at 20mA Drain

**SOURCE CURRENT:** 30mA Maximum

**SINK CURRENT:** 20mA Maximum

**OUTPUT IMPEDANCE:** < 0.3 Ohm

**INPUT RESISTANCE (READ MODE):** > 2 Megohms

**SOURCE RESISTANCE EFFECT (READ MODE):** 0.1% error per 2000 Ohms

**OVERLOAD PROTECTION:** Protected to 120V AC or DC

**OVERLOAD INDICATOR:** Lamp indicates high current or misconnection

**SHORT CIRCUIT DURATION:** Continuous

**LOW VOLTAGE INDICATOR:** LO BAT ARROW turns on at 18 Volts (approximately 10 operating hours remain)

**TEMPERATURE EFFECT:**  $\pm 0.01\%/^{\circ}\text{C}$  (Based on 25°C  $\pm 25^{\circ}\text{C}$  Recommended Range)

**RECOMMENDED OPERATING TEMPERATURE:** 32 to 122°F (0 to 50°C)

**OPERATING AMBIENT TEMPERATURE:** Minus 5 to plus 140°F (minus 20 to plus 60°C)

**STORAGE TEMPERATURE:** Minus 22 to plus 175°F (minus 30 to plus 80°C)

**RELATIVE HUMIDITY:** 10 to 90%, non-condensing

**WARM UP TIME:** 3 seconds to rated accuracy

**OVERALL SIZE:** 2½ × 2 × 5½ inches (63.5 × 66.7 × 130mm)

**WEIGHT:** 12.5 oz. (0.35 kg)

**AC ADAPTORS:** Optional; 120 or 240V, 50/60 Hz

**CARRYING CASE:** Optional, zippered with belt loop

### ALTEK INDUSTRIES CORP.

210 Commerce Drive  
Rochester, New York 14623 U.S.A.  
(716) 334-3720  
FAX: (716) 334-6673

## OPERATING INSTRUCTIONS

### SOURCE MODE

Disconnect one or both input wires from the device to be checked or calibrated. Attach the red (+) lead of the ALTEK MODEL 235 to the plus input of the device to be calibrated, connect the black (-) lead to the minus terminal. Select the desired range and turn the SOURCE/OFF/READ mode selector switch to the SOURCE position. Actual voltage sent to the receiving device is shown on the LCD.

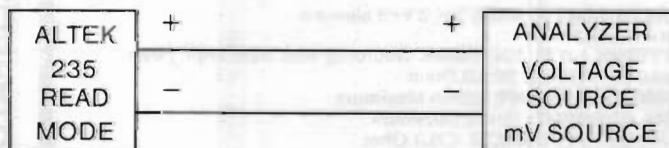
Output voltage is continuously adjustable with the QUIK-CHEK switch in the DIAL position. The source voltage can be set to any exact value from 0 to 200mV, 0 to 20V or -25 to 125% of 1 to 5V. HI and LO values are user adjustable and can be instantly selected by the QUIK-CHEK switch.



### READ MODE

Place the leads of the MODEL 235 across the voltage signal to be measured. Place the MODE Switch in the READ position and select the range to be measured. Choose the 100mV position for signals from -199.9mV to +199.9mV. Signals from -19.99V to +19.99V can be measured with the 10V range. 1 to 5V signals can be displayed in units of 0 to 100% to monitor live process signals.

When measuring voltages from high impedance sources, the source resistance effect is 0.1% per 2000 Ohms. All ranges are fully protected to 120V AC against misconnection.



### WARRANTY

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from date of shipment.

Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option.

The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incidental or consequential damage.

### ORDERING INFORMATION:

MODEL 235: Process Voltage Analyzer  
AC Adapter: 120V AC  
AC Adapter: 240V AC  
Carrying Case

### Part No.

235-0010  
28-0120  
28-0240  
09-3781

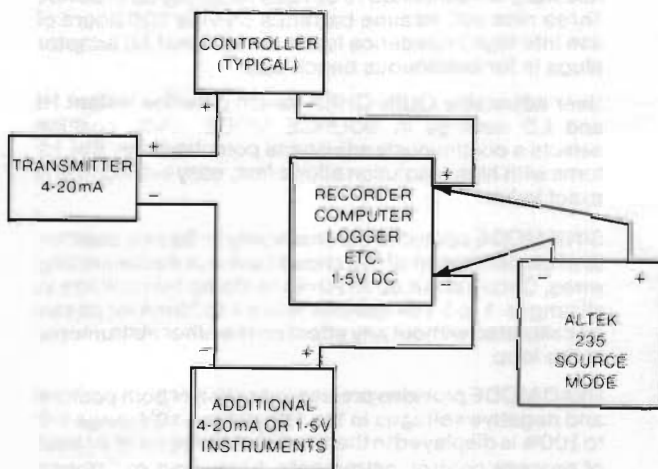
### SINK MODE (OPERATES AUTOMATICALLY IN SOURCE MODE)

Any 1 to 5V device in a 4 to 20mA loop can be calibrated without breaking the loop or turning off the signal current. Clip the red lead to the positive input terminal and the black lead to the negative of the device to be checked or calibrated. It is not necessary to disconnect any associated 250 Ohm resistor. Make certain that changing the signal input will not disturb the process or cause unexpected alarms when checking on-line instruments.

It is important to remember the Model 235 drives only the device to which it is connected. It has no effect on other devices in the 4 to 20mA loop.

Set the RANGE switch to the 1 to 5 Volt range and the MODE switch to SOURCE. The LCD will display 0 to 100% corresponding to the 1 to 5 Volts required by the device being calibrated. The voltage is set to any exact value by the 10 turn dial. Adjust HI and LO trimmers to desired values for fastest repetitive calibration through the QUIK-CHEK switch.

Additionally, SINK MODE will clamp the selected value in the 100mV and 10V Ranges to the maximum sink current of 20mA. For example, receivers requiring 0.25 to 1.25V may be calibrated in the 10 Volt range. Connect the Model 235 across the 62.5 Ohm resistor and set the LO and HI QUIK-CHEKS for 0.25 and 1.25V.



### OTHER PRODUCTS

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal. Consult our factory directly or your local supplier to order precise, low cost Milliamp, RTD, Thermocouple, Voltage and Frequency Calibrators. Additional models and ranges are frequently added to the Altek instrument family to meet all of your critical calibration requirements.

### AVAILABLE FROM:



# DC MILLIVOLT/VOLTAGE SOURCES

## ALTEK

- **THREE MODELS**

135-0.1 0-100 millivolts

135-1 0-1 volt

135-10 0-10 volts

- **DIGITAL ADJUSTMENT**

Continuous. . . 0-100%=0.00 to Full Scale

- **POCKET SIZED**

2-1/8 X 4 X 2-1/4 inches

- **"QUIK-CHEK"™ SWITCH**

Selects "00.0%", "Dial" and "100%"

- **BUILT-IN BATTERIES**

High Efficiency design

ALTEK'S family of **Precision Voltage Sources**, Series 135, provide DC voltage outputs into a wide variety of receivers.

Built-in batteries provide continuously adjustable voltage output from 0 to 100% of range. Optional 120 VAC or 240 VAC adapters allow full-time bench use.

In addition to the 0.1% accurate digital dial adjustments, switch selected signals are provided at 00.0% and 100% for "QUIK-CHEK" zero and full scale settings.

Pocket sized and lightweight, the ALTEK Model 135 is ideal for use in the field, control room and shop. Small size is made possible through up-to-date design including a precision reference, ultra stable amplifier and high current power output. Accuracy, stability and low power consumption are combined through the use of the latest microcircuitry.

Continuous adjustability with memory lock assures fast, precise settings of meter circuits, voltage trips, recorders, data loggers, controllers, computers and final control elements. Built-in long life batteries allow complete portability for checkout and calibration of all voltage input devices.

ALTEK brings you the handy Model 135 voltage Sources at a cost low enough for every bench and toolbox.



| OUTPUT VOLTAGE |         |       |        |
|----------------|---------|-------|--------|
| Dial Setting   | 135-0.1 | 135-1 | 135-10 |
| %              | 0-100mV | 0-1V  | 0-10V  |
| 00.0           | 00.0    | 00.0  | 00.0   |
| 05.0           | 05.0    | .050  | 0.50   |
| 10.0           | 10.0    | .100  | 1.00   |
| 15.0           | 15.0    | .150  | 1.50   |
| 20.0           | 20.0    | .200  | 2.00   |
| 25.0           | 25.0    | .250  | 2.50   |
| 30.0           | 30.0    | .300  | 3.00   |
| 35.0           | 35.0    | .350  | 3.50   |
| 40.0           | 40.0    | .400  | 4.00   |
| 45.0           | 45.0    | .450  | 4.50   |
| 50.0           | 50.0    | .500  | 5.00   |
| 55.0           | 55.0    | .550  | 5.50   |
| 60.0           | 60.0    | .600  | 6.00   |
| 65.0           | 65.0    | .650  | 6.50   |
| 70.0           | 70.0    | .700  | 7.00   |
| 75.0           | 75.0    | .750  | 7.50   |
| 80.0           | 80.0    | .800  | 8.00   |
| 85.0           | 85.0    | .850  | 8.50   |
| 90.0           | 90.0    | .900  | 9.00   |
| 95.0           | 95.0    | .950  | 9.50   |
| 00.0           | 100     | 1.00  | 10.0   |

Note: decimal point not shown on dial.

DATA SHEET 135 Additional Voltage Calibrators: See DATA SHEETS 235 & 222

### ALTEK INDUSTRIES CORP.

210 Commerce Drive  
Rochester, New York 14623 U.S.A.  
(716) 334-3720  
FAX: (716) 334-6673

## SPECIFICATIONS, ALTEK MODEL 135

(unless otherwise indicated, specifications are in % of span)

**Calibrated Accuracy:**  $\pm 0.1\%$  from 1% to 99%

**"QUICK-CHEK":**  $\pm 0.08\%$  at 0.00% and 100.0%

**Resolution:** 0.02%

**Built-in Batteries:** 1 or 2-9 Volt Alkaline

**AC Adapter:** 28-0120, 28-0240 for 120 or 240V 50/60 Hz

**Minimum Load Resistance:** (For 0.1% Load Effect)

135-0.1 100 OHMS

135-1 100 OHMS

135-10 500 OHMS

**Nominal Output Impedance:**

135-0.1 0.1 OHMS

135-1 0.1 OHMS

135-10 0.5 OHMS

**Battery Life:**

Continuous Output:

500 Hours into high impedance loads

**Power Supply Effect:** 0.005%/Volt

**Battery Check:** momentary switch position causes lamp glow

**Operating Ambient Temperature:** Minus 10 to plus 140 degrees F (Minus 25 to plus 60 degrees C)

**Temperature Effect:**  $\pm 0.01\%$ /degree C

**Storage Temperature Limits:** Minus 40 to plus 160 degrees F (Minus 40 to plus 70 degrees C). Remove batteries if stored for extended period.

**Warm-up Time:** 2 seconds to rated accuracy

**Size:** 2-1/8 X 4 X 2-1/4 inches (54 X 102 X 55mm)

**Weight:** 11 ounces (0.3 kg)

**Carrying Case:** Optional, zippered with belt loop

## ORDERING INFORMATION

|               |                  | Part No. |
|---------------|------------------|----------|
| Model 135     | 0-100mV Source   | 135-0.1  |
|               | 0-1V Source      | 135-1    |
|               | 0-10V Source     | 135-10   |
| Carrying Case |                  | 09-3781  |
| AC Adapter    | 120 VAC 50/60 Hz | 28-0120  |
| AC Adapter    | 240 VAC 50/60 Hz | 28-0240  |

## OTHER PRODUCTS

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal.

Consult our factory directly or contact your local stocking representative to order precise, low cost Milliamp Calibrators, Voltage Sources, Direct Thermocouple Sources, RTD Simulators and Frequency Sources. Altek also produces calibrators for custom ranges and unique applications.

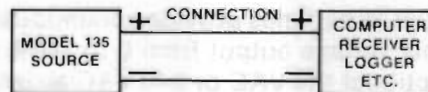
Additional models and ranges are frequently added to the Altek instrument family to meet all of your critical calibration requirements. Altek products are made in the USA.

## OPERATING INSTRUCTIONS

Disconnect any existing input wires from the device to be checked or calibrated. Turn the selector switch (left side) to the "ON" position.

Connect the red plus (+) lead to the plus input of the device to be checked or calibrated. Connect the black minus (-) lead to the minus terminal.

"00.0%", "Dial" adjustment and "100%" are selected with the right hand switch. Fast zero and full scale checks can be made by means of the "00.0%" and the "100%" positions. A third quick check position may be established by adjusting the digital dial to the desired percent value and locking it in place. The continuous adjustment digital dial reads directly in percent of the signal. For example, a dial setting of 500 is 50% of span. Complete the adjustments and turn the ALTEK Model 135 off. Reconnect any wires removed for check out.



## WARRANTY

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from date of shipment.

Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option.

The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incidental or consequential damage.

## AVAILABLE FROM:

**ALTEK**

# UNIVERSAL THERMOCOUPLE CALIBRATOR MODEL 422

- **14 T/C TYPES PLUS MV BUILT-IN**  
J, K, T, E, R, S, B, N, G, C, D, P, L, U & mV
- **TEMPERATURE INPUT & OUTPUT**  
Reads directly in degrees
- **"QUIK-CHEK™" SWITCH**  
Select HI, LO & SET
- **45 OUTPUT MEMORIES**  
Three for each T/C type & mV
- **0.007% ACCURACY °C or °F**  
Field selectable 0.1°, 1° or 1 µV resolution



## GENERAL DESCRIPTION

### THERMOCOUPLE CALIBRATOR

SOURCE and READ T/C's over the entire industrial temperature range with ALTEK's Model 422 Thermocouple Calibrator. Use with transmitters, recorders, controllers, alarms, indicators, data acquisition and computer systems. Switch between 14 T/C types or millivolts.

High accuracy and stability is achieved through Altek's exclusive isothermal block. Make your connections directly with thermocouple wire or with miniature thermocouple connectors.

Field customize the Model 422 to lock-in 0.1° or 1° resolution, fixed °F or °C or front panel selectable °F/°C operation. A shrouded miniature thermocouple connector receptacle plus terminal screws allow for easy hookups. Built in protection guards the Model 422 against mis-connection to 120 Volts AC or DC, in any mode.

The Model 422 turns on to the T/C type last used. Other T/C types may be selected each time the unit is turned on. If you use less than 14 T/C types, you can create your own T/C List. By following a simple setup procedure you can deselect unwanted T/C types to customize T/C types available at turn on.

### "SOURCE" MODE SIMULATES A T/C SENSOR

Select resolution of 0.1° or 1° for the full listed range of all thermocouple types. Millivolts allows 1 microvolt resolution from -99.999 to 99.999mV. The ALTEK Model 422 simulates key temperatures for repetitive calibrations. "QUIK-CHEK" function stores THREE output temperatures for each T/C type (45 total) for real convenience. Three memories are retained for each thermocouple type even when the power is off.

Turn the knob to check trip points, controller action or hysteresis. The fast response 422 sets quickly without overshoot but allows slow changes at your own rate.

### "READ" MODE MEASURES T/C'S DIRECTLY

The Model 422 display gives you fast, accurate temperature measurement with 0.1 and 1 degree or with 0.001 millivolt resolution. High resistance or open T/Cs and leads are detected and indicated on the LCD display. Two readings per second track fast moving temperatures.

"MAX" and "MIN" memories are continuously updated from turn-on or whenever the "RESET" pushbutton is pressed. The Model 422 gives you a handy tool to monitor temperatures for drift or control deviation. Just flip the "QUIK-CHEK" switch to display the MINimum and MAXimum temperature since reset.

### TURN ON SEQUENCE

Each time the Model 422 is turned on, the LCD will display all segments for 1 second. It then displays the currently selected thermocouple type or mV for approximately 3 seconds. If °C/°F operation has been selected the currently selected temperature scale of °C or °F will display.

## ALTEK INDUSTRIES CORP

210 Commerce Drive  
Rochester, New York 14623 U.S.A.  
(716) 334-3720  
FAX: (716) 334-6673



# OPERATING INSTRUCTIONS

## GENERAL

### INITIAL SETUP

The Model 422 is internally configurable for ease of use. Simply remove the four corner screws, flip a few DIP switches and follow the simple instructions given below (a condensed guide is found within the calibrator housing). The choices are based on the type of instruments in your shop or plant. For instance if your plant has only type E and your instruments display to 1°C, set up the Model 422 to lock out T/C type selection, choose full time °C and display with 1° resolution.

### CONFIGURING TEMPERATURE SCALES

°F

°C

The Model 422 may be internally set-up for full time use of °C, full time use of °F or selectable °C/°F operation. The selectable mode lets you choose °C or °F each time the unit is turned on (see Configuring Operating Modes below).

### LOCKING IN 1° RESOLUTION

100.0°

100°

The Model 422 may be internally configured for 0.1° or 1° resolution. Select 1° resolution for less critical applications or 0.1° for increased resolution when necessary.

### CHANGING T/C TYPES

Up to 14 T/C types plus millivolts may be selected each time the Model 422 is turned on.

To change T/C types:

J K T E  
R S B N  
G C D P  
L U mV

- 1) Repeatedly press or press and hold the SCROLL pushbutton when switching the unit on or while a T/C type is displayed during the first three seconds after the unit is turned on.
- 2) Continue to hold the SCROLL pushbutton. The LCD will scroll through the list of T/C types & mV.
- 3) Release the SCROLL pushbutton when the desired T/C type is displayed.

### Changing the list of available T/C types:

You may create your own T/C list which can be changed at any time.

J K T E  
R S B N  
G C D P  
L U mV

- 1) Turn the Model 422 off & remove the 4 corner screws.
- 2) Set DIP Switch 2 up (see Configuring Operating Modes below).
- 3) Turn the 422 on.
- 4) Turn the digital pot (Source Adjustment Knob) to scroll through each T/C type.
- 5) Press the STORE/SCROLL pushbutton to select (Steady) or deselect (Flashing) T/C types to add to the T/C list.
- 6) Continue turning the digital pot to review the selections. Press STORE/SCROLL pushbutton to change any selections.
- 7) Turn the 422 off, place DIP Switch 2 down & replace the 4 corner screws.

### CONNECTIONS

The Model 422 has connections for both miniature thermocouple connectors and for direct thermocouple wires. It is essential for accurate calibration that thermocouple wire is used to connect the Model 422 to the device being calibrated. Miniature or subminiature thermocouple connectors with thermocouple wire allow for the easiest connection. Different size thermocouple connectors may be used with an adaptor of the same thermocouple type. Copper wires, Copper connectors or Copper adaptors are not recommended as they will cause errors in cold junction compensation. Copper is used only for millivolt applications.



### OVER RANGE/UNDER RANGE

OVER  
UNDER

Out-of-range temperatures are indicated by OVER and UNDER on the display. If out-of-range is displayed during READ mode check for proper connections and T/C type.

### TURN-ON

MAX -88888°F  
HI  
LO BAT OVER READ  
MIN UNDER SOURCE M

Each time the Model 422 is turned on, the LCD will display all segments for about 1 second. It then displays the currently selected thermocouple type for approximately 3 seconds. The currently selected temperature scale of °C or °F will then display for about 3 seconds. Depending on the configuration, from 1 to 14 T/C types, millivolts or °C or °F may be selected during the thermocouple turn-on mode.

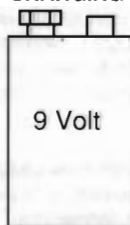
- 1) Move the power switch to SOURCE or READ
- 2) All segments on the LCD are turned on during self test
- 3) The display will indicate the selected T/C type for 3 seconds. Repeatedly press or press and hold the SCROLL pushbutton to change to the desired T/C type (based on configuration).
- 4) The display will indicate the selected temperature scale for 3 seconds. Press the SCROLL pushbutton to switch between °C & °F (based on configuration).

If a single T/C type, fixed °C or fixed °F have been selected, the user prompts for these selections will be skipped during turn-on.

The three "QUIK-CHEK" temperature values will be the same as previously stored. Each time a different T/C type is selected, the three "QUIK-CHEK" values for that type will be recalled.

Hint: The Model 422 will automatically convert the temperatures in memory between °F and °C. For example, if 212.0°F is stored in HI and the Model 422 is switched to °C, 100.0°C will be displayed.

### CHANGING BATTERY



Low battery is indicated by BAT on the LCD Display. Approximately 10 Hours of operation remain before the LCD goes blank and the Model 422 shuts itself down. Turn the 422 off, remove the four corner screws and lift the unit out of the case. The battery is fastened to the bottom printed circuit board and is easily removed. Replace screws and turn on when ready to use.

### CONFIGURING OPERATING MODES

#### (Setting DIP Switches)

- 1) Turn the Model 422 OFF
- 2) Remove the 4 corner screws and lift faceplate assembly out of the case
- 3) Set the DIP switches for your options as diagrammed below

Note: °C/°F selection is the default for shipments in the U.S.A. °C for all other countries.

Fixed 1°  
(Switch Up)  
1

Autoranging\*  
(Switch Down)  
1

Changing T/C List  
2

Selectable T/C Types  
2

\*Factory Settings (Switches 1 and 2 Down)

Fixed °F  
3 4

Fixed °C  
3 4

°C/°F Switchable\*\*  
3 4

1 Factory Setting — USA  
2 Factory Setting — All other countries

## OPERATING INSTRUCTIONS

### SOURCE MODE (Millivolt output or Simulate T/C temperatures)

#### SOURCE



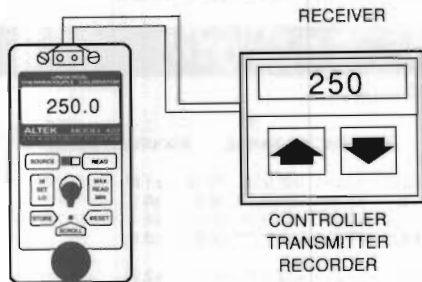
STORE ● RESET

#### OUTPUT

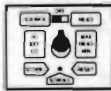


- 1) Set up the Model 422 for the correct T/C type and temperature scale (°C or °F)
- 2) Disconnect the input wires from the device to be calibrated or checked
- 3) Connect the Model 422 to the device to be calibrated, being careful to observe proper polarity & T/C type
- 4) Adjust the digital pot to the desired output value

Whenever SOURCE mode is selected the word SOURCE will appear on the LCD display. To change the output value, turn the speed sensitive digital pot. Turning the pot slowly will cause a gradual change in the output. A faster change will occur when the pot is turned faster. This function operates in all three output positions (HI, SET & LO).



#### STORE



- 1) Switch to HI or LO
- 2) Turn the digital pot to desired value
- 3) Press the STORE/SCROLL pushbutton. The LCD will flash once to show that the value was saved

If a value is in the SET position and you want that value stored in HI or LO, press and hold the STORE/SCROLL pushbutton while moving the switch to HI or LO. Then release the STORE button.

#### "QUIK-CHEK"



#### OVERLOAD

Any time you need a stored value just throw the "QUIK-CHEK" switch. Any value in the T/C range may be stored in HI & LO. The Model 422 remembers the HI, LO and SET values for all T/C types (45 memories) and millivolts for you with the power on or off. Each time a different T/C type is selected, the latest three "QUIK-CHEK" values for that type will be recalled.

The Model 422 will indicate OVER and blank the digits on the display when the output leads have been shorted or when the device being calibrated requires more than 10mA.

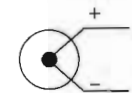
### READ MODE (MEASURE THERMOCOUPLES)

#### READ



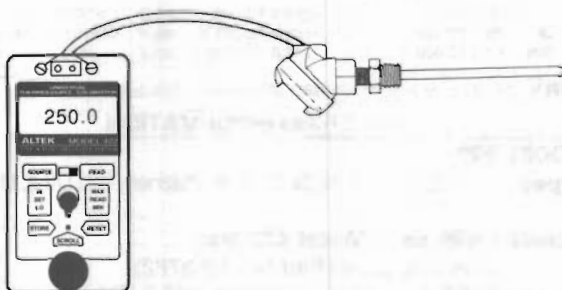
STORE ● RESET

#### INPUT



- 1) Set up the Model 422 for the correct T/C type and temperature scale (°C or °F)
- 2) Disconnect the wires from the thermocouple to be read or checked.
- 3) Connect the Model 422 to the sensor, being careful to observe proper polarity & T/C type
- 4) Display present reading, Maximum or Minimum temperatures

Whenever READ mode is selected the word READ will appear on the LCD. The Model 422 can measure temperatures for all T/C types with resolutions of 0.1° and 1°. The display is updated twice per second to continuously track fast moving temperatures.

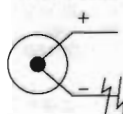


#### MIN/MAX



To read the Maximum or Minimum temperature since INPUT mode was entered, simply switch to MAX or MIN. The value will appear on the LCD along with the word MAX or MIN. The MAX/MIN values are automatically updated and may be viewed at any time without disturbing the other values. Pressing the RESET/SCROLL pushbutton will transfer the present temperature into both MAX and MIN and will update them as the measured temperature changes.

#### OPEN THERMOCOUPLES



The Model 422 checks for open or high resistance thermocouples. Open or burned out T/Cs are indicated by "— — —" on the display. Temperatures out of range for the T/C TYPE selected will be indicated by OVER and UNDER on the display.

### PYROMETER CALIBRATION

Some thermocouple input pyrometers and controllers operate on the D'Arsonval meter movement principle. Millivolts from the thermocouple input drive a low resistance coil directly. For example, a coil may have a typical resistance of 60 ohms. Since the pyrometer resistance is so low, resistance of the input thermocouple leads must be taken into account. Pyrometers of this type have fixed or adjustable series resistance which corrects for lead length resistance.

#### To use the Model 422 to drive low resistance loads:

- 1) Disconnect the sensing thermocouple leads at the thermocouple head.
- 2) Connect leads from the Model 422 to the extension wires going to the pyrometer, using the screw connectors in the head. (If the sensing thermocouple sheath is within 1/4 to 2 times the length of the Model 422 lead length, the error due to resistance will be negligible).
- 3) Set the temperatures to be used for calibration per the recommendation of the pyrometer manufacturer.

#### If the thermocouple head cannot be accessed:

- 1) Determine the installed length of extension wire between the head and the pyrometer.
- 2) Select thermocouple extension wire of the same type, wire size and length as the installed wire between the head and the pyrometer to make up a calibrating wire.
- 3) Replace the active thermocouple extension wire with the calibrating wire at the pyrometer terminals.
- 4) Connect the other ends of the calibrating wire to the Model 422 and calibrate the pyrometer.

Note: A resistor of the same ohm value as the wire between the head and the pyrometer may be used in series with one lead instead of a length of calibrating wire. Make certain that both input and output leads to the resistor are the same temperature.

# SPECIFICATIONS

## GENERAL

GENERAL ACCURACY:  $\pm 0.007\%$  of 200 millivolt Span @ 25°C  
 COLD JUNCTION COMPENSATION: Built-in for specified thermocouple type, characterized to T/C curve  
 COLD JUNCTION TEMPERATURE EFFECT: Within 0.05° per °C change in ambient temperature over operating range  
 OPERATING TEMPERATURE RANGE: -5 to +140°F (-20 to +60°C)  
 STORAGE TEMPERATURE RANGE: -22 to +175°F (-30 to +80°C)  
 RELATIVE HUMIDITY: 10 to 90%, non-condensing  
 ZERO STABILITY: Included in Cold junction effect  
 WARM UP TIME: 1 Minute to full rated accuracy  
 OVERLOAD PROTECTION: 120 volts AC/DC for 30 seconds on connecting leads, in any mode  
 BATTERY LIFE: 9 Volt Alkaline: 40 hours  
 LOW BATTERY: "BAT" indication on LCD at 7 Volts nominal, approximately 10 hours left  
 REFERENCE DRIFT: <10 PPM/°C

OVERALL SIZE: 2 1/2 x 2 5/8 x 5 1/8 inches (63.5 x 66.7 x 130 mm)  
 WEIGHT: 10.9 oz. (0.31kg)  
 CARRYING CASE: Included, zippered with belt loop and shoulder strap

## SOURCE MODE

OUTPUT IMPEDANCE: <0.1 ohms  
 SOURCE CURRENT: up to 8 mA (drives 80mV into 10 Ohms)  
 OUTPUT NOISE: <4 microvolts p-p for frequencies of 10 Hz or below  
 OVERLOAD: Indicates OVER and blanks digits on the display

## READ MODE

INPUT IMPEDANCE: >10 Megohms  
 OPEN THERMOCOUPLE DETECTION: 450 millisecond check pulse. Nominal threshold, 10 K Ohms. Displays "— — —" for open circuit  
 NORMAL MODE REJECTION: 50/60 Hz, 50 dB  
 COMMON MODE REJECTION: 50/60 Hz, 120 dB

## RANGES & ACCURACIES

Based on  $\pm(0.008\%$  of Reading +0.006 millivolts)

| T/C TYPE | °C RANGE         | ACCURACY        | °F RANGE         | ACCURACY        | T/C MATERIAL | ISA/ANSI COLOR |
|----------|------------------|-----------------|------------------|-----------------|--------------|----------------|
| <b>J</b> | -210.0 TO -180.0 | $\pm 0.3^\circ$ | -346.0 TO -292.0 | $\pm 0.5^\circ$ | +IRON        | WHITE          |
|          | -180.0 TO -50.0  | $\pm 0.2^\circ$ | -292.0 TO -58.0  | $\pm 0.4^\circ$ | -CONSTANTAN  | RED            |
|          | 50.0 TO 500.0    | $\pm 0.1^\circ$ | -58.0 TO 932.0   | $\pm 0.2^\circ$ | JACKET       | BLACK          |
|          | 500.0 TO 1200.0  | $\pm 0.2^\circ$ | 932.0 TO 2192.0  | $\pm 0.4^\circ$ |              |                |
| <b>K</b> | -230.0 TO -100.0 | $\pm 0.6^\circ$ | -382.0 TO -148.0 | $\pm 1.1^\circ$ | +CHROMEL     | YELLOW         |
|          | -100.0 TO 1050.0 | $\pm 0.2^\circ$ | -148.0 TO 1922.0 | $\pm 0.4^\circ$ | -ALUMEL      | RED            |
|          | 1050.0 TO 1372.0 | $\pm 0.3^\circ$ | 1922.0 TO 2500.0 | $\pm 0.5^\circ$ | JACKET       | YELLOW         |
| <b>T</b> | -260.0 TO -200.0 | $\pm 1.0^\circ$ | -436.0 TO -328.0 | $\pm 1.8^\circ$ | +COPPER      | BLUE           |
|          | -200.0 TO -50.0  | $\pm 0.5^\circ$ | -328.0 TO -58.0  | $\pm 0.9^\circ$ | -CONSTANTAN  | RED            |
|          | -50.0 TO 0.0     | $\pm 0.2^\circ$ | -58.0 TO 32.0    | $\pm 0.4^\circ$ | JACKET       | BLUE           |
|          | 0.0 TO 400.0     | $\pm 0.1^\circ$ | 32.0 TO 752.0    | $\pm 0.2^\circ$ |              |                |
| <b>E</b> | -240.0 TO -200.0 | $\pm 0.4^\circ$ | -400.0 TO -328.0 | $\pm 0.7^\circ$ | +CHROMEL     | PURPLE         |
|          | -200.0 TO -100.0 | $\pm 0.2^\circ$ | -328.0 TO -148.0 | $\pm 0.4^\circ$ | -CONSTANTAN  | RED            |
|          | -100.0 TO 850.0  | $\pm 0.1^\circ$ | -148.0 TO 1562.0 | $\pm 0.2^\circ$ | JACKET       | PURPLE         |
|          | 850.0 TO 1000.0  | $\pm 0.2^\circ$ | 1562.0 TO 1832.0 | $\pm 0.4^\circ$ |              |                |
| <b>R</b> | 0.0 TO 250.0     | $\pm 1.0^\circ$ | 32.0 TO 482.0    | $\pm 1.8^\circ$ | +Pt13Rh      | BLACK          |
|          | 250.0 TO 750.0   | $\pm 0.6^\circ$ | 482.0 TO 1382.0  | $\pm 1.1^\circ$ | -PLATINUM    | RED            |
|          | 750.0 TO 1600.0  | $\pm 0.5^\circ$ | 1382.0 TO 2912.0 | $\pm 0.9^\circ$ | JACKET       | GREEN          |
|          | 1600.0 TO 1768.0 | $\pm 0.6^\circ$ | 2912.0 TO 3214.0 | $\pm 1.1^\circ$ |              |                |
| <b>S</b> | 0.0 TO 100.0     | $\pm 1.0^\circ$ | 32.0 TO 212.0    | $\pm 1.8^\circ$ | +Pt10Rh      | BLACK          |
|          | 100.0 TO 400.0   | $\pm 0.8^\circ$ | 212.0 TO 752.0   | $\pm 1.4^\circ$ | -PLATINUM    | RED            |
|          | 400.0 TO 1700.0  | $\pm 0.6^\circ$ | 752.0 TO 3092.0  | $\pm 1.1^\circ$ | JACKET       | GREEN          |
|          | 1700.0 TO 1768.0 | $\pm 0.7^\circ$ | 3092.0 TO 3214.0 | $\pm 1.3^\circ$ |              |                |
| <b>B</b> | 538.0 TO 900.0   | $\pm 1.1^\circ$ | 1000.0 TO 1652.0 | $\pm 2.0^\circ$ | +Pt30Rh      | GREY           |
|          | 900.0 TO 1150.0  | $\pm 0.7^\circ$ | 1652.0 TO 2102.0 | $\pm 1.3^\circ$ | -Pt6Rh       | RED            |
|          | 1150.0 TO 1820.0 | $\pm 0.6^\circ$ | 2102.0 TO 3308.0 | $\pm 1.1^\circ$ | JACKET       | GREY           |

| T/C TYPE             | °C RANGE         | ACCURACY        | °F RANGE         | ACCURACY        | T/C MATERIAL    | ISA/ANSI COLOR |
|----------------------|------------------|-----------------|------------------|-----------------|-----------------|----------------|
| <b>N</b>             | -230.0 TO -180.0 | $\pm 1.0^\circ$ | -382.0 TO -292.0 | $\pm 1.8^\circ$ | +NICROSIL       | ORANGE         |
|                      | -180.0 TO -50.0  | $\pm 0.5^\circ$ | -292.0 TO -58.0  | $\pm 0.9^\circ$ | -NISIL          | RED            |
|                      | -50.0 TO 1100.0  | $\pm 0.2^\circ$ | -58.0 TO 2012.0  | $\pm 0.4^\circ$ | JACKET          | ORANGE         |
|                      | 1100.0 TO 1300.0 | $\pm 0.3^\circ$ | 2012.0 TO 2372.0 | $\pm 0.5^\circ$ |                 |                |
| <b>G</b><br>(W)      | 100.0 TO 150.0   | $\pm 1.2^\circ$ | 212.0 TO 302.0   | $\pm 2.2^\circ$ | +Tungsten       | WHITE          |
|                      | 150.0 TO 400.0   | $\pm 0.8^\circ$ | 302.0 TO 752.0   | $\pm 1.4^\circ$ | -W26/Re         | RED            |
|                      | 400.0 TO 1700.0  | $\pm 0.4^\circ$ | 752.0 TO 3092.0  | $\pm 0.7^\circ$ | JACKET          | WHITE/BLUE     |
|                      | 1700.0 TO 2320.0 | $\pm 0.7^\circ$ | 3092.0 TO 4208.0 | $\pm 1.3^\circ$ |                 |                |
| <b>C</b><br>(W5)     | 0.0 TO 1500.0    | $\pm 0.5^\circ$ | 32.0 TO 2372.0   | $\pm 0.9^\circ$ | +W5/Re          | WHITE          |
|                      | 1500.0 TO 1900.0 | $\pm 0.6^\circ$ | 2372.0 TO 3452.0 | $\pm 1.1^\circ$ | -W26/Re         | RED            |
|                      | 1900.0 TO 2100.0 | $\pm 0.7^\circ$ | 3452.0 TO 3812.0 | $\pm 1.3^\circ$ | JACKET          | WHITE/RED      |
|                      | 2100.0 TO 2320.0 | $\pm 0.9^\circ$ | 3812.0 TO 4208.0 | $\pm 1.6^\circ$ |                 |                |
| <b>D</b>             | 0.0 TO 50.0      | $\pm 0.6^\circ$ | 32.0 TO 122.0    | $\pm 1.1^\circ$ | +W3/Re          | WHITE          |
|                      | 50.0 TO 1400.0   | $\pm 0.4^\circ$ | 122.0 TO 2552.0  | $\pm 0.7^\circ$ | -W25/Re         | RED            |
|                      | 1400.0 TO 1800.0 | $\pm 0.5^\circ$ | 2552.0 TO 3272.0 | $\pm 0.9^\circ$ | JACKET          | WHT/YEL        |
|                      | 1800.0 TO 2320.0 | $\pm 0.9^\circ$ | 3272.0 TO 4208.0 | $\pm 1.6^\circ$ |                 |                |
| <b>P</b><br>Platinel | -250.0 TO -150.0 | $\pm 1.2^\circ$ | -418.0 TO -238.0 | $\pm 2.2^\circ$ | +Pd55/Pt31/Au14 | YEL            |
|                      | -150.0 TO -50.0  | $\pm 0.4^\circ$ | -238.0 TO -58.0  | $\pm 0.7^\circ$ | -Au65/Pd35      | RED            |
|                      | -50.0 TO 1000.0  | $\pm 0.2^\circ$ | -58.0 TO 1832.0  | $\pm 0.4^\circ$ | JACKET          | BLACK          |
|                      | 1000.0 TO 1395.0 | $\pm 0.3^\circ$ | 1832.0 TO 2543.0 | $\pm 0.5^\circ$ |                 |                |
| <b>L</b><br>J DIN    | -200.0 TO -50.0  | $\pm 0.2^\circ$ | -328 TO -58.0    | $\pm 0.4^\circ$ | +IRON           | RED            |
|                      | -50.0 TO 500.0   | $\pm 0.1^\circ$ | -58.0 TO 932.0   | $\pm 0.2^\circ$ | -CONSTANTAN     | BLUE           |
|                      | 500.0 TO 750.0   | $\pm 0.2^\circ$ | 932.0 TO 1832.0  | $\pm 0.4^\circ$ | JACKET          | BLUE           |
|                      |                  |                 |                  |                 |                 |                |
| <b>U</b><br>T DIN    | -200.0 TO -75.0  | $\pm 0.3^\circ$ | -328.0 TO -103.0 | $\pm 0.5^\circ$ | +COPPER         | RED            |
|                      | -75.0 TO 100.0   | $\pm 0.2^\circ$ | -103.0 TO 212.0  | $\pm 0.4^\circ$ | -CONSTANTAN     | BROWN          |
|                      | 100.0 TO 600.0   | $\pm 0.1^\circ$ | 212.0 TO 1112.0  | $\pm 0.2^\circ$ | JACKET          | BROWN          |
|                      |                  |                 |                  |                 |                 |                |

mV -99.999 to 99.999 mV  $\pm(0.008\%$  of Reading +0.006 millivolts)

## WARRANTY

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from date of shipment. Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option. The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incidental or consequential damage.

## OTHER PRODUCTS

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal. Consult our factory directly or your local supplier to order precise, low cost Milliamp, RTD, Thermocouple, Voltage and Frequency Calibrators. Additional models and ranges are frequently added to the Altek instrument family to meet all of your critical calibration requirements.

## AVAILABLE FROM:

## ORDERING INFORMATION

### MODEL 422

Types J, K, T, E, R, S, B, N, G, C, D, P (Platinel), L (J DIN), U (T DIN)

### Included with each Model 422 are:

Carrying Case (Part No. 09-3782)  
 NIST Traceable Certificate and 3 Year Warranty

## OPTIONAL ACCESSORIES

### PLUG IN WIRE KITS

Contains T/C Wires, 1 Meter long, terminated at one end with a miniature T/C connector.

MODEL KIT-1 (Types J, T, E, K)

MODEL KIT-2 (Types B, R/S, K)

Contact factory for additional T/C Types



## MULTIPLE THERMOCOUPLE CALIBRATOR MODEL 322

- **STANDARD MODELS**  
Types J, T, E, K and MV  
Types B, R, S, K and MV
- **CUSTOM MODELS**  
Select desired combination from 14 T/C Types
- **TEMPERATURE INPUT & OUTPUT**  
Reads directly in degrees
- **"QUIK-CHEK™" SWITCH**  
Three points, HI, LO & SET
- **15 OUTPUT MEMORIES**  
Three for each T/C type & MV
- **0.007% ACCURACY, 1° or 0.1° RESOLUTION**



### GENERAL DESCRIPTION

#### THERMOCOUPLE CALIBRATOR

SOURCE and READ T/C's over the entire industrial temperature range with ALTEK's Model 322 Thermocouple Calibrator. Use with transmitters, recorders, controllers, alarms, indicators, data acquisition and computer systems. Switch between four T/C types or millivolts.

High accuracy and stability is achieved through Altek's exclusive isothermal block. Make your connections directly with thermocouple wire or with miniature thermocouple connectors.

Field customize the Model 322 to lock-in 1° resolution, fixed °F or °C or front panel selectable °F/°C operation. A shrouded miniature thermocouple connector receptacle plus terminal screws allow for easy hookups. Built-in protection guards the Model 322 against mis-connection to 120 Volts AC or DC, in any mode.

The Model 322 turns on to the T/C type last used. Other T/C types may be selected each time the unit is turned on. If you always use one T/C type, lock in the selected T/C type (ex. type J) with the internal DIP switch to prevent accidental change to an unwanted type.

#### "SOURCE" MODE SIMULATES A T/C SENSOR

Resolution is 0.1° or 1° over the full listed range of all thermocouple types. Millivolts provides 1 microvolt resolution from -99.999 to 99.999mV. The ALTEK model 322 simulates key temperatures for repetitive calibrations. "QUIK-CHEK" function stores THREE output temperatures for each T/C type for real convenience.

Three output values are remembered for each T/C type & MV for a total of 15. Turn the knob to check trip points, controller action or hysteresis. The fast response 322 sets quickly without overshoot but allows slow changes at your own rate. Memory is retained for each thermocouple type even when power is off.

#### "READ" MODE MEASURES T/C'S DIRECTLY

The Model 322 display gives you fast, accurate temperature measurement with 0.1 and 1 degree or with 0.001 millivolt resolution. High resistance or open T/Cs and leads are detected and indicated on the LCD display. Two readings per second track fast moving temperatures.

"MAX" and "MIN" memories are continuously updated from turn-on or whenever the "RESET" pushbutton is pressed. The Model 322 gives you a handy tool to monitor temperatures for drift or control deviation. Just flip the "QUIK-CHEK" switch to display the MINimum and MAXimum temperature since reset.

#### TURN ON SEQUENCE

Each time the Model 322 is turned on, the LCD will display all segments for 1 second. It then displays the currently selected thermocouple type or mV for approximately 3 seconds. If °C/°F operation has been selected the currently selected temperature scale of °C or °F will display.

#### ALTEK INDUSTRIES CORP

210 Commerce Drive  
Rochester, New York 14623 U.S.A.  
(716) 334-3720  
FAX: (716) 334-6673

# OPERATING INSTRUCTIONS

## GENERAL

### INITIAL SETUP

The Model 322 is internally configurable for ease of use. Simply remove the four corner screws, flip a few DIP switches and follow the simple instructions given below (a condensed guide is found within the calibrator housing). The choices are based on the type of instruments in your shop or plant. For instance if your plant has only type E and your instruments display to 1°C, set up the Model 322 to lock out T/C type selection, choose full time °C and display with 1° resolution.

### CONFIGURING TEMPERATURE SCALES

°F

°C

The Model 322 may be internally set-up for full time use of °C, full time use of °F or selectable °C/°F operation. The selectable mode lets you choose °C or °F each time the unit is turned on. If your facility is completely in °F or °C, set the internal DIP switches of the 322 to operate as a dedicated °F or °C instrument (see Configuring Operating Modes below).

### LOCKING IN 1° RESOLUTION



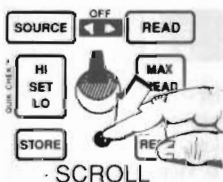
The Model 322 may be internally configured for 0.1° or 1° resolution. Select 1° resolution for less critical applications or 0.1° for increased resolution when necessary.

### CHANGING T/C TYPES

JTEK  
RSBL  
mV

Four T/C types or millivolts may be selected each time the Model 322 is turned on.

To change T/C types:



- 1) Repeatedly press or press and hold the SCROLL pushbutton when switching the unit on or while a T/C type is displayed during the first three seconds after the unit is turned on.
- 2) Continue to hold the SCROLL pushbutton. The LCD will scroll through the 4 T/C types and mV.
- 3) Release the SCROLL pushbutton when the desired T/C type is displayed.

To lock in a single T/C type:

An internal DIP switch may be used to disable the front panel selection to permanently lock in a single T/C type.

- 1) Change to the desired T/C type (as above)
- 2) Set DIP Switch 2 up (see Configuring Operating Modes below)

## CONNECTIONS

The Model 322 has connections for both miniature thermocouple connectors and for direct thermocouple wires. It is essential for accurate calibration that thermocouple wire is used to connect the Model 322 to the device being calibrated. Miniature or subminiature thermocouple connectors with thermocouple wire allow for the easiest connection. Different size thermocouple connectors may be used with an adaptor of the same thermocouple type. Copper wires, Copper connectors or Copper adaptors are not recommended as they will cause errors in cold junction compensation. Copper is used only for millivolt applications.



### OVER RANGE/UNDER RANGE

OVER  
UNDER

Out-of-range temperatures are indicated by OVER and UNDER on the display. If out-of-range is displayed during READ mode check for proper connections and T/C type.

### TURN-ON



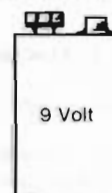
Each time the Model 322 is turned on the LCD will display all segments for about 1 second. It then displays the currently selected thermocouple type for approximately 3 seconds. The currently selected temperature scale of °C or °F will then display for about 3 seconds. Depending on the configuration from 1 to 4 T/C types, millivolts or °C or °F may be selected during the thermocouple turn-on mode.

- 1) Move the power switch to SOURCE or READ
- 2) All segments on the LCD are turned on during self test
- 3) The display will indicate the currently selected T/C type for 3 seconds. Repeatedly press or press and hold the SCROLL pushbutton to change to the desired T/C type (based on configuration).
- 4) The display will indicate the currently selected temperature scale for 3 seconds. Press the SCROLL pushbutton to switch between °C & °F (based on configuration).

If a single T/C type, fixed °C or fixed °F have been selected, the user prompts for these selections will be skipped during turn-on. The three "QUIK-CHEK" temperature values will be the same as previously stored. Each time a different T/C type is selected, the three "QUIK-CHEK" values for that type will be recalled.

Hint: The Model 322 will automatically convert the temperatures in memory between °F and °C. For example, if 212°F is stored in HI and the Model 322 is switched to °C, 100°C will be displayed.

### CHANGING BATTERY

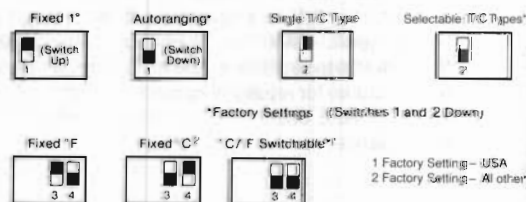


Low battery is indicated by BAT on the LCD Display. Approximately 10 Hours of operation remain before the LCD goes blank and the Model 322 shuts itself down. Turn the 322 off, remove the four corner screws and lift the unit out of the case. The battery is fastened to the bottom printed circuit board and is easily removed.

## CONFIGURING OPERATING MODES

### (DIP SWITCHES)

- 1) Turn the Model 322 OFF
  - 2) Remove the 4 corner screws and lift faceplate assembly out of the case
  - 3) Set the DIP switches for your options as diagrammed below
- Note: °C/°F selection is the default for shipments in the U.S.A. °C for all other countries.



ALTEK INDUSTRIES CORP  
Rochester, NY 14623 USA

# OPERATING INSTRUCTIONS

## SOURCE MODE (Millivolt output or Simulate T/C temperatures)

### SOURCE



STORE ● RESET

### OUTPUT



- 1) Set up the Model 322 for the correct T/C type and temperature scale (°C or °F)
- 2) Disconnect the input wires from the device to be calibrated or checked
- 3) Connect the Model 322 to the device to be calibrated, being careful to observe proper polarity & T/C type
- 4) Adjust the digital pot to the desired output value

Whenever SOURCE mode is selected the word SOURCE will appear on the LCD display. To change the output value, turn the speed sensitive digital pot. Turning the pot slowly will cause a gradual change in the output. A faster change will occur when the pot is turned faster. This function operates in all three output positions (HI, SET & LO).

### STORE



- 1) Switch to HI or LO
- 2) Turn the digital pot to desired value
- 3) Press the STORE/SCROLL pushbutton

If a value is in the SET position and you want that value stored in HI or LO, press and hold the STORE/SCROLL pushbutton while moving the switch to HI or LO. Then release the STORE button.

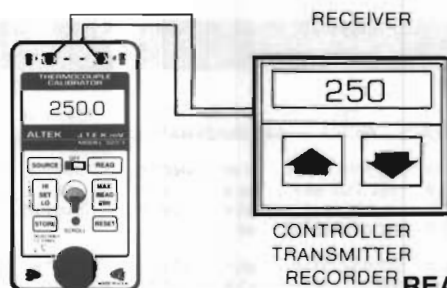
### "QUIK-CHEK"



Any time you need a stored value just throw the "QUIK-CHEK" switch. Any value in the T/C range may be stored in HI & LO. The Model 322 remembers the HI, LO and SET values for all T/C types (15 memories) and millivolts for you with the power on or off. Each time a different T/C type is selected, the latest three "QUIK-CHEK" values for that type will be recalled.

### OVERLOAD

The Model 322 will indicate OVER and blank the digits on the display when the output leads have been shorted or when the device being calibrated requires more than 10mA.



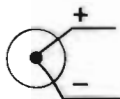
## READ MODE (MEASURE THERMOCOUPLES)

### READ



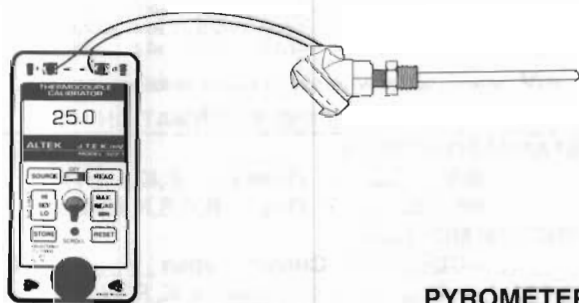
STORE ● RESET

### INPUT



- 1) Set up the Model 322 for the correct T/C type and temperature scale (°C or °F)
- 2) Disconnect the wires from the thermocouple to be read or checked.
- 3) Connect the Model 322 to the sensor, being careful to observe proper polarity & T/C type
- 4) Display present reading, Maximum or Minimum temperatures

Whenever READ mode is selected the word READ will appear on the LCD. The Model 322 can measure temperatures for all T/C types with resolutions of 0.1° and 1°. The display is updated twice per second to continuously track fast moving temperatures.

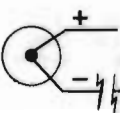


### MIN/MAX



To read the Maximum or Minimum temperature since INPUT mode was entered, simply switch to MAX or MIN. The value will appear on the LCD along with the word MAX or MIN. The MAX/MIN values are automatically updated and may be viewed at any time without disturbing the other values. Pressing the RESET/SCROLL pushbutton will transfer the present temperature into both MAX and MIN and will update them as the measured temperature changes.

### OPEN THERMOCOUPLES



The Model 322 checks for open or high resistance thermocouples. Open or burned out T/CS are indicated by "— — —" on the display. Temperatures out of range for the T/C TYPE selected will be indicated by OVER and UNDER on the display.

## PYROMETER CALIBRATION

Some thermocouple input pyrometers and controllers operate on the D'Arsonval meter movement principle. Millivolts from the thermocouple input drive a low resistance coil directly. For example, a coil may have a typical resistance of 60 ohms. Since the pyrometer resistance is so low, resistance of the input thermocouple leads must be taken into account. Pyrometers of this type have fixed or adjustable series resistance which corrects for lead length resistance.

To use the Model 322 to drive low resistance loads:

- 1) Disconnect the sensing thermocouple leads at the thermocouple head.
- 2) Connect leads from the Model 322 to the extension wires going to the pyrometer, using the screw connectors in the head. (If the sensing thermocouple sheath is within 1/4 to 2 times the length of the Model 322 lead length, the error due to resistance will be negligible.)
- 3) Set the temperatures to be used for calibration per the recommendation of the pyrometer manufacturer.

If the thermocouple head cannot be accessed:

- 1) Determine the installed length of extension wire between the head and the pyrometer.
- 2) Select thermocouple extension wire of the same type, wire size and length as the installed wire between the head and the pyrometer to make up a calibrating wire.
- 3) Replace the active thermocouple extension wire with the calibrating wire at the pyrometer terminals.
- 4) Connect the other ends of the calibrating wire to the Model 322 and calibrate the pyrometer.

Note: A resistor of the same ohm value as the wire between the head and the pyrometer may be used in series with one lead instead of a length of calibrating wire. Make certain that both input and output leads to the resistor are the same temperature.



# SPECIFICATIONS

## GENERAL

GENERAL ACCURACY:  $\pm 0.007\%$  of 200 millivolt Span @ 25°C  
 COLD JUNCTION COMPENSATION: Built-in for specified thermocouple type, characterized to T/C curve  
 COLD JUNCTION TEMPERATURE EFFECT: Within 0.05° per °C change in ambient temperature over operating range  
 OPERATING TEMPERATURE RANGE: -5 to +140°F (-20 to +60°C)  
 STORAGE TEMPERATURE RANGE: -22 to +175°F (-30 to +80°C)  
 RELATIVE HUMIDITY: 10 to 90%, non-condensing  
 ZERO STABILITY: Included in Cold junction effect  
 WARM UP TIME: 1 Minute to rated accuracy  
 OVERLOAD PROTECTION: 120 volts AC/DC for 30 seconds on connecting leads, in any mode  
 BATTERY LIFE: 9 Volt Alkaline: 40 hours  
 LOW BATTERY: "BAT" indication on LCD at 7 Volts nominal, approximately 10 hours left  
 REFERENCE DRIFT: <10 PPM/°C

OVERALL SIZE: 2 1/2 x 2 5/8 x 5 1/8 inches (63.5 x 66.7 x 130 mm)  
 WEIGHT: 10.9 oz. (0.31kg)  
 CARRYING CASE: Included, zippered with belt loop and shoulder strap  
**SOURCE MODE**

OUTPUT IMPEDANCE: <0.1 ohms  
 SOURCE CURRENT: up to 8 mA (drives 80mV into 10 Ohms)  
 OUTPUT NOISE: <4 microvolts p-p for frequencies of 10 Hz or below  
 OVERLOAD: Indicates OVER and blanks digits on the display

## READ MODE

INPUT IMPEDANCE: >10 Megohms  
 OPEN THERMOCOUPLE DETECTION: 450 millisecond check pulse. Nominal threshold, 10 K Ohms. Displays " — — — " for open circuit  
 NORMAL MODE REJECTION: 50/60 Hz, 50 dB  
 COMMON MODE REJECTION: 50/60 Hz, 120 dB

## RANGES & ACCURACIES

Based on  $\pm(0.008\%$  of Reading +0.006 millivolts)

| T/C TYPE | °C RANGE         | ACCURACY        | °F RANGE         | ACCURACY        | T/C MATERIAL | ISA/ANSI COLOR | T/C TYPE        | °C RANGE         | ACCURACY        | °F RANGE         | ACCURACY        | T/C MATERIAL    | ISA/ANSI COLOR |
|----------|------------------|-----------------|------------------|-----------------|--------------|----------------|-----------------|------------------|-----------------|------------------|-----------------|-----------------|----------------|
| <b>J</b> | -210.0 TO -180.0 | $\pm 0.3^\circ$ | -346.0 TO -292.0 | $\pm 0.5^\circ$ | +IRON        | WHITE          | <b>N</b>        | -230.0 TO -180.0 | $\pm 1.0^\circ$ | -382.0 TO -292.0 | $\pm 1.8^\circ$ | +NICROSIL       | ORANGE         |
|          | -180.0 TO -50.0  | $\pm 0.2$       | -292.0 TO -58.0  | $\pm 0.4$       | -CONSTANTAN  | RED            |                 | -180.0 TO -50.0  | $\pm 0.5$       | -292.0 TO -58.0  | $\pm 0.9$       | -NISIL          | RED            |
|          | 50.0 TO 500.0    | $\pm 0.1$       | -58.0 TO 932.0   | $\pm 0.2$       | JACKET       | BLACK          |                 | -50.0 TO 1100.0  | $\pm 0.2$       | -58.0 TO 2012.0  | $\pm 0.4$       | JACKET          | ORANGE         |
|          | 500.0 TO 1200.0  | $\pm 0.2$       | 932.0 TO 2192.0  | $\pm 0.4$       |              |                |                 | 1100.0 TO 1300.0 | $\pm 0.3$       | 2012.0 TO 2372.0 | $\pm 0.5$       |                 |                |
| <b>K</b> | -230.0 TO -100.0 | $\pm 0.6^\circ$ | -382.0 TO -148.0 | $\pm 1.1^\circ$ | +CHROMEL     | YELLOW         | <b>G</b>        | 100.0 TO 150.0   | $\pm 1.2^\circ$ | 212.0 TO 302.0   | $\pm 2.2^\circ$ | +Tungsten       | WHITE          |
|          | -100.0 TO 1050.0 | $\pm 0.2$       | -148.0 TO 1922.0 | $\pm 0.4$       | -ALUMEL      | RED            |                 | 150.0 TO 400.0   | $\pm 0.8$       | 302.0 TO 752.0   | $\pm 1.4$       | -W26/Re         | RED            |
|          | 1050.0 TO 1372.0 | $\pm 0.3$       | 1922.0 TO 2500.0 | $\pm 0.5$       | JACKET       | YELLOW         |                 | 400.0 TO 1700.0  | $\pm 0.4$       | 752.0 TO 3092.0  | $\pm 0.7$       | JACKET          | WHITE/BLUE     |
| <b>T</b> | -260.0 TO -200.0 | $\pm 1.0^\circ$ | -436.0 TO -328.0 | $\pm 1.8^\circ$ | +COPPER      | BLUE           | <b>(W)</b>      | 1700.0 TO 2320.0 | $\pm 0.7$       | 3092.0 TO 4208.0 | $\pm 1.3$       |                 |                |
|          | -200.0 TO -50.0  | $\pm 0.5$       | -328.0 TO -58.0  | $\pm 0.9$       | -CONSTANTAN  | RED            |                 | 0.0 TO 1500.0    | $\pm 0.5^\circ$ | 32.0 TO 2372.0   | $\pm 0.9^\circ$ | +W5/Re          | WHITE          |
|          | -50.0 TO 0.0     | $\pm 0.2$       | -58.0 TO 32.0    | $\pm 0.4$       | JACKET       | BLUE           |                 | 1500.0 TO 1900.0 | $\pm 0.6$       | 2372.0 TO 3452.0 | $\pm 1.1$       | -W26/Re         | RED            |
| <b>E</b> | 0.0 TO 400.0     | $\pm 0.1$       | 32.0 TO 752.0    | $\pm 0.2$       |              |                | <b>(W5)</b>     | 1900.0 TO 2100.0 | $\pm 0.7$       | 3452.0 TO 3812.0 | $\pm 1.3$       | JACKET          | WHITE/RED      |
|          | -240.0 TO -200.0 | $\pm 0.4^\circ$ | -400.0 TO -328.0 | $\pm 0.7^\circ$ | +CHROMEL     | PURPLE         |                 | 2100.0 TO 2320.0 | $\pm 0.9$       | 3812.0 TO 4208.0 | $\pm 1.6$       |                 |                |
|          | -200.0 TO -100.0 | $\pm 0.2$       | -328.0 TO -148.0 | $\pm 0.4$       | -CONSTANTAN  | PURPLE         | <b>D</b>        | 0.0 TO 50.0      | $\pm 0.6^\circ$ | 32.0 TO 122.0    | $\pm 1.1^\circ$ | +W3/Re          | WHITE          |
| <b>R</b> | -100.0 TO 850.0  | $\pm 0.1$       | -148.0 TO 1562.0 | $\pm 0.2$       | JACKET       | PURPLE         |                 | 50.0 TO 1400.0   | $\pm 0.4$       | 122.0 TO 2552.0  | $\pm 0.7$       | -W25/Re         | RED            |
|          | 850.0 TO 1000.0  | $\pm 0.2$       | 1562.0 TO 1832.0 | $\pm 0.4$       |              |                |                 | 1400.0 TO 1800.0 | $\pm 0.5$       | 2552.0 TO 3272.0 | $\pm 0.9$       | JACKET          | WHT/YEL        |
|          | 0.0 TO 250.0     | $\pm 1.0^\circ$ | 32.0 TO 482.0    | $\pm 1.8^\circ$ | +Pt/13Rh     | BLACK          | <b>P</b>        | 1800.0 TO 2320.0 | $\pm 0.9$       | 3272.0 TO 4208.0 | $\pm 1.6$       |                 |                |
| <b>S</b> | 250.0 TO 750.0   | $\pm 0.6$       | 482.0 TO 1382.0  | $\pm 1.1$       | -PLATINUM    | RED            |                 | -250.0 TO -150.0 | $\pm 1.2^\circ$ | -418.0 TO -238.0 | $\pm 2.2^\circ$ | +Pd55/Pt31/Au14 | YEL            |
|          | 750.0 TO 1600.0  | $\pm 0.5$       | 1382.0 TO 2912.0 | $\pm 0.9$       | JACKET       | GREEN          |                 | -150.0 TO -50.0  | $\pm 0.4$       | -238.0 TO -58.0  | $\pm 0.7$       | -Au65/Pd35      | RED            |
|          | 1600.0 TO 1768.0 | $\pm 0.6$       | 2912.0 TO 3214.0 | $\pm 1.1$       |              |                | <b>Platinel</b> | -50.0 TO 1000.0  | $\pm 0.2$       | -58.0 TO 1832.0  | $\pm 0.4$       | JACKET          | BLACK          |
| <b>B</b> | 0.0 TO 100.0     | $\pm 1.0^\circ$ | 32.0 TO 212.0    | $\pm 1.8^\circ$ | +Pt/10Rh     | BLACK          |                 | 1000.0 TO 1395.0 | $\pm 0.3$       | 1832.0 TO 2543.0 | $\pm 0.5$       |                 |                |
|          | 100.0 TO 400.0   | $\pm 0.8$       | 212.0 TO 752.0   | $\pm 1.4$       | -PLATINUM    | RED            | <b>L</b>        | -200.0 TO -50.0  | $\pm 0.2^\circ$ | -328.0 TO -58.0  | $\pm 0.4^\circ$ | +IRON           | RED            |
|          | 400.0 TO 1700.0  | $\pm 0.6$       | 752.0 TO 3092.0  | $\pm 1.1$       | JACKET       | GREEN          |                 | -50.0 TO 500.0   | $\pm 0.1$       | -58.0 TO 932.0   | $\pm 0.2$       | -CONSTANTAN     | BLUE           |
| <b>U</b> | 1700.0 TO 1768.0 | $\pm 0.7$       | 3092.0 TO 3214.0 | $\pm 1.3$       |              |                |                 | 500.0 TO 750.0   | $\pm 0.2$       | 932.0 TO 1832.0  | $\pm 0.4$       | JACKET          | BLUE           |
|          | 538.0 TO 900.0   | $\pm 1.1^\circ$ | 1000.0 TO 1652.0 | $\pm 2.0^\circ$ | +Pt/30Rh     | GREY           | <b>J DIN</b>    | -200.0 TO -75.0  | $\pm 0.3^\circ$ | -328.0 TO -103.0 | $\pm 0.5^\circ$ | +COPPER         | RED            |
|          | 900.0 TO 1150.0  | $\pm 0.7$       | 1652.0 TO 2102.0 | $\pm 1.3$       | -Pt/6Rh      | RED            |                 | -75.0 TO 100.0   | $\pm 0.2$       | -103.0 TO 212.0  | $\pm 0.4$       | -CONSTANTAN     | BROWN          |
|          | 1150.0 TO 1820.0 | $\pm 0.6$       | 2102.0 TO 3308.0 | $\pm 1.1$       | JACKET       | GREY           |                 | 100.0 TO 600.0   | $\pm 0.1$       | 212.0 TO 1112.0  | $\pm 0.2$       | JACKET          | BROWN          |

mV -99.999 to 99.999 mV  $\pm(0.008\%$  of Reading +0.006 millivolts)

## WARRANTY

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from date of shipment. Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option. The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incidental or consequential damage.

## OTHER PRODUCTS

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal. Consult our factory directly or your local supplier to order precise, low cost Milliamp, RTD, Thermocouple, Voltage and Frequency Calibrators. Additional models and ranges are frequently added to the Altek instrument family to meet all of your critical calibration requirements.

## AVAILABLE FROM:

## ORDERING INFORMATION

### STANDARD MODELS

MODEL 322-1 (Types J,T,E,K & mV)

MODEL 322-2 (Types B,R,S,K & mV)

### CUSTOM MODELS

MODEL 322 - Custom Types \_\_\_\_\_ & MV

Example: 322-Custom J, K, R, N, MV

(Choose any four T/C types from the following list)

J, K, T, E, R, S, B, N, G, C, D, P (Platinel), L (J DIN), U (T DIN)

### Included with each Model 322 are:

Carrying Case (Part No. 09-3782)

NIST Traceable Certificate and 3 Year Warranty

## OPTIONAL ACCESSORIES

### PLUG IN WIRE KITS

Contains T/C Wires, 1 Meter long, terminated at one end with a miniature T/C connector.

MODEL KIT-1 (Types J, T, E, K)

MODEL KIT-2 (Types B, R/S, K)

Contact factory for additional T/C Types

**ALTEK**

## THERMOCOUPLE CALIBRATOR MODEL 222

- **TEMPERATURE INPUT & OUTPUT**  
Reads directly in degrees
- **"QUIK-CHEK"™ SWITCH**  
Instant HI, LO and SET
- **MULTI-SPEED DIGITAL POT**  
Fast, accurate setting
- **0.04% ACCURACY**  
Field selectable F or C
- **CALIBRATES PYROMETERS**  
Drives up to 8 mA
- **LINEAR MILLIVOLT MODEL**  
10 $\mu$ V Resolution



ALTEK Series 222 Digital Thermocouple Calibrators give you continuous INPUT and OUTPUT function over the entire industrial temperature range. Measure and simulate thermocouples for indicators, pyrometers, transmitters, recorders, controllers, alarms, data acquisition and computer systems. Each Model 222 is dedicated to a particular thermocouple type for error-free use.

Built-in flexible T/C leads let you connect directly, using the proper T/C materials. Automatic linearized cold junction compensation virtually eliminates temperature drift. Fuseless protection guards the Model 222 against mis-connection to 120 volts AC or DC, in any mode.

Select your Model 222 from Thermocouple types B, E, J, K, R, S, T, C, N and L (J-DIN). Or choose the linear millivolt version, Model 222-MV, to measure and simulate analyzer signals. Consult Altek for thermocouple types not listed.

### ALTEK INDUSTRIES CORP

210 Commerce Drive  
Rochester, New York 14623 U.S.A.  
(716) 334-3720

FAX: (716) 334-6673

DATA SHEET 222

ADDITIONAL Thermocouple Calibrators: See DATA SHEETS 322 & 22

## GENERAL DESCRIPTION

### "OUT" MODE SIMULATES WIDE THERMOCOUPLE RANGE

Thermocouple output adjusts with a unique multi-speed rotary-to-digital "potentiometer." Rotate the pot continuously in either direction to set any value quickly and accurately. Up to 8 mA output current is delivered to the receiver, enough to drive most pyrometers.

The Altek Model 222 sources key temperatures for repetitive calibrations. The "QUIK-CHEK" stores THREE output temperatures for real convenience. Store any temperature in either "HI" or "LO" registers. Test above or below stored values... just turn the knob up and down to check trip points, control action or hysteresis. Memory is retained even when power is off.

### PYROMETER COMPATIBLE

The 8 mA current capability and low output impedance of the Model 222 make it ideal for calibrating meter movement pyrometers.

### "IN" MODE READS THERMOCOUPLES DIRECTLY

The digital indicator gives you fast, accurate temperature measurement

with 0.1 and 1 degree resolution. High input impedance assures accuracy in long thermocouple runs or with fine T/C wires. Burned out or abnormally high resistance thermocouples are detected by a low energy pulse. Two readings per second track fast moving temperatures.

"MAX" and "MIN" memories are continuously updated from turn-on or whenever the "RESET" button is pressed. The Model 222 gives you a handy tool to monitor temperatures for drift or control deviation. Just flip the toggle switch to display the minimum and maximum temperature measured since reset.

The Model 222-MV provides continuous INPUT and OUTPUT function with 10 $\mu$ V and 100 $\mu$ V resolution. Measure and simulate millivolts for analyzers, loggers, strain gauges, data acquisition and computer systems. Special thermocouple types may also be measured and simulated with the addition of an external cold junction compensator. Built in leads are terminated in alligator clips for fast and easy connections. Fuseless protection guards the Model 222-MV against misconnection to 120 Volts AC or DC, in any mode.

## OPERATING INSTRUCTIONS

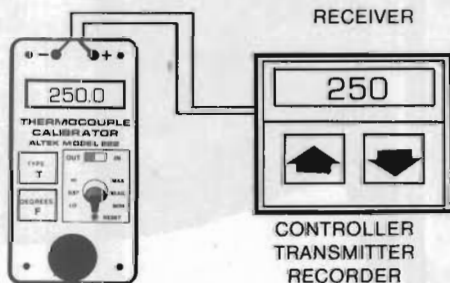
### OUT - SOURCE MODE

#### OUT



STORE RESET

- 1) Select the correct ALTEK MODEL 222 for the thermocouple type and scale
- 2) Disconnect one or both input wires from the device to be calibrated or checked
- 3) RANGE
  - 1 Degree Resolution
  - Move the 222 power switch from OFF to OUT
  - 0.1 Degree Resolution (T/C types E, J, K, T, L)
  - Press & hold the STORE pushbutton while moving the power switch to OUT
- 4) Adjust the digital pot to the desired output value
- 5) Connect the Model 222 to the device to be calibrated, being careful to observe polarity



#### OUTPUT



To change the output value, turn the speed sensitive digital pot. Turning the pot slowly will cause a gradual change in the output (2 to 4 clicks of the pot to change one digit). A faster change will occur when the pot is turned faster. A filter circuit limits response when the pot is turned too fast. This function operates in all three output positions (HI, SET & LO).

#### STORE



- 1) Switch to HI (or LO)
- 2) Turn the digital pot to desired value
- 3) Press STORE

If a value is in the SET position and you want that value in HI or LO, press and hold the STORE button while moving the switch to HI or LO. This lets you store a new temperature with 0.1° or 1° resolution where a temperature with the other resolution was stored.

#### "QUIK-CHEK"



Any time you need a stored value just throw the "QUIK-CHEK" switch. Any value in the thermocouple range may be stored in HI & LO in either 0.1° and 1° resolution. The Model 222 remembers the HI, LO and SET values for you with the power on or off.

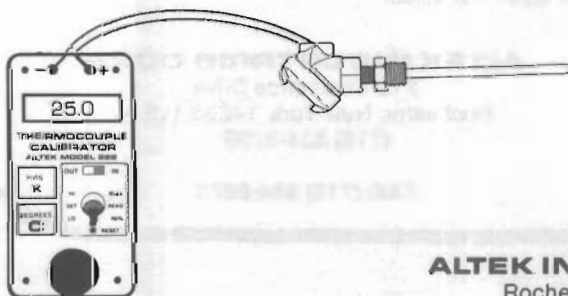
### IN - READ MODE

#### IN

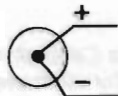


STORE RESET

- 1) Select the ALTEK MODEL 222 for the correct thermocouple type and scale
- 2) RANGE
  - 1 Degree Resolution
  - Move the 222 power switch from OFF to IN
  - 0.1 Degree Resolution (T/C types E, J, K, T, N, L)
  - Press & hold the STORE pushbutton while moving the power switch to IN
- 3) Connect the thermocouple or probe to be measured to the leads of the Model 222, being careful to observe polarity
- 4) Display the present reading, Maximum or Minimum temperatures



#### INPUT



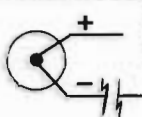
The Model 222 can measure temperatures in two ranges with resolutions of 0.1° and 1°. The display is updated twice per second to continuously track fast moving temperatures. The high input impedance provides accurate readings in long thermocouple runs or with fine T/C wires.

#### MIN/MAX



To read the Maximum or Minimum temperature since INPUT mode was entered simply switch to MAX or MIN. The MAX/MIN values are automatically updated and may be viewed at any time without disturbing the other values. Pressing RESET will transfer the present temperature into both MAX and MIN and will update them as the measured temperature changes.

#### OPEN THERMOCOUPLES



The Model 222 checks for open or high resistance thermocouples. Open or burned out thermocouples are indicated by " — — — — " on the display.



# OPERATING INSTRUCTIONS

## PYROMETER CALIBRATION

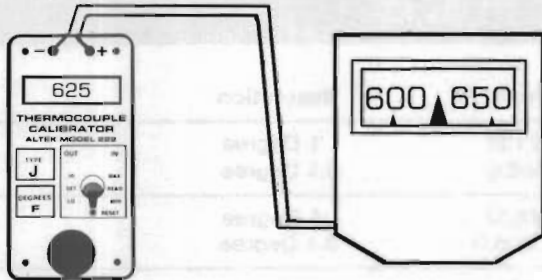
Some thermocouple input pyrometers and controllers operate on the D'Arsonval meter movement principle. Millivolts from the thermocouple input drive a low resistance coil directly. For example, a coil may have a typical resistance of 80 ohms. Since the pyrometer resistance is so low, resistance of the input thermocouple leads must be taken into account. Pyrometers of this type have fixed or adjustable series resistors which correct for lead length resistance.

### To use the Model 222 to drive low resistance loads:

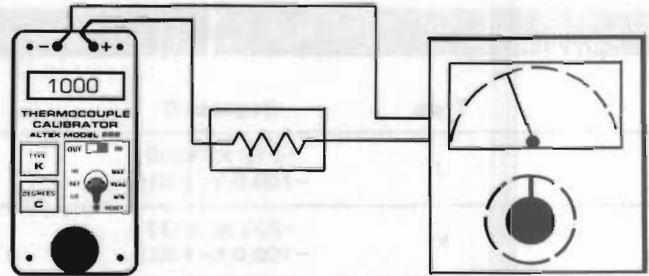
- 1) Disconnect the sensing thermocouple leads at the thermocouple head.
- 2) Connect the leads of the Model 222 to the extension wires going to the pyrometer, using the screw connectors in the head. (If the sensing thermocouple sheath is within  $\frac{1}{4}$  to 2 times the length of the Model 222 lead length, the error due to resistance will be negligible.)
- 3) Set the temperatures to be used for calibration per the recommendation of the pyrometer manufacturer. The output may need to be re-adjusted due to the loading effect of the pyrometer.

### If the thermocouple head cannot be accessed:

- 1) Determine the installed length of extension wire between the head and the pyrometer.
  - 2) Select thermocouple extension wire of the same type, wire size and length as the installed wire between the head and the pyrometer to make up a calibrating wire.
  - 3) Replace the active thermocouple extension wire with the calibrating wire at the pyrometer terminals.
  - 4) Connect the other ends of the calibrating wire to the same colored leads of the Model 222 and calibrate the pyrometer.
- Note: A resistor of the same ohm value as the wire between the head and the pyrometer may be used in series with one lead instead of a length of calibrating wire. Make certain that both input and output leads to the resistor are the same temperature.

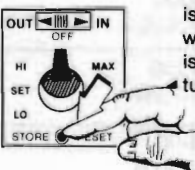


222-MV



The Model 222-MV measures from -500.0 to 999.9 millivolts with  $100\mu\text{V}$  resolution and from -50.00 to 99.99 millivolts with  $10\mu\text{V}$  resolution. The display is updated twice per second to track rapidly changing values.

### SELECTING $100\mu\text{V}$ OR $10\mu\text{V}$ RESOLUTION



Resolution is selected whenever the Model 222-MV is turned on. If the Model 222-MV is turned on without holding the STORE button,  $100\mu\text{V}$  resolution is selected. If the STORE button is held down while turning the unit on,  $10\mu\text{V}$  resolution is selected.

## GENERAL

### SELECTING $1^\circ$ OR $0.1^\circ$ RESOLUTION



Resolution is selected for T/C types E, J, K, T, N or L whenever the Model 222 is turned on. If the Model 222 is turned on without holding the STORE button,  $1^\circ$  is selected. If the STORE button is held while turning the unit on,  $0.1^\circ$  resolution is selected.

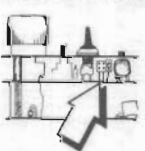
Note: The "QUICK-CHEK" HI and LO temperatures will remain in the resolution in which they were stored until a new value is transferred from the SET position. The SET position will be in the resolution selected at turn-on.

### SELECTING $^\circ\text{F}$ OR $^\circ\text{C}$



The Model 222 may be jumper configured in one of three modes. The first two modes are for full time use in  $^\circ\text{F}$  or full time use in  $^\circ\text{C}$ . The third mode allows front panel selection of  $^\circ\text{F}$  or  $^\circ\text{C}$  each time the unit is turned on. If your facility is completely in  $^\circ\text{F}$  or  $^\circ\text{C}$ , connect the internal jumper of the 222 to operate as a dedicated  $^\circ\text{F}$  or dedicated  $^\circ\text{C}$  instrument.

### CHANGING MODE JUMPERS



- 1) Remove the 4 corner screws and lift faceplate assembly out of the case
- 2) Remove TAG from the faceplate and rearrange it to show the  $^\circ\text{F}$ ,  $^\circ\text{C}$  or  $^\circ\text{F}/^\circ\text{C}$  instructions on top
- 3) Move the MODE JUMPER to the  $^\circ\text{F}$ ,  $^\circ\text{C}$  or the  $^\circ\text{F}/^\circ\text{C}$  position



The LCD will display the scale selected when the Model 222 is operating. Be sure that the TAG shows the proper scale before replacing the corner screws.

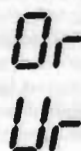
### USING F/C MODE



In F/C mode the temperature scale is selected by setting the "QUICK-CHEK" switch before turning the unit on. Place the switch to HI/MAX to select  $^\circ\text{F}$  or LO/MIN to select  $^\circ\text{C}$ . If the unit is turned on with the switch in the SET/READ position the temperature scale most recently used will be displayed.

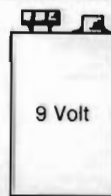
Hint: The Model 222 will automatically convert the temperatures in memory between  $^\circ\text{F}$  and  $^\circ\text{C}$ . For example, if  $212^\circ\text{F}$  is stored in HI and the Model 222 is switched to  $^\circ\text{C}$ ,  $100^\circ\text{C}$  will be displayed.

### OVER RANGE/UNDER RANGE



Out-of-range temperatures are indicated by Or and Ur on the display. (If the decimal point is present, then the Model 222 is set for  $0.1^\circ$  resolution.) During OUT mode, re-adjust the output by turning the knob or selecting the  $1^\circ$  resolution range. Check for proper polarity, thermocouple type and range if out-of-range is displayed during IN mode.

### CHANGING BATTERY



Low battery is indicated by BAT on the LCD Display. Approximately 10 hours of operation remain before the LCD goes blank and the Model 222 shuts itself down. Remove the four corner screws and lift the unit out of the case. The battery is fastened to the bottom printed circuit board and is easily removed.

Hint: If the new battery is installed within 30 seconds of removing the old battery the "QUICK-CHEK" values will remain in memory.

## SPECIFICATIONS

(Unless otherwise specified, specifications are in  $\pm\%$  of Span in degrees, @ 25 Degrees C)

### GENERAL

**ACCURACY:**  $0.04\% \pm 10$  microvolts  
**COLD JUNCTION COMPENSATION:** Built-in for specified thermocouple type, characterized to T/C curve  
**COLD JUNCTION TEMPERATURE EFFECT:** Within 0.25 Degrees  $\pm 0.05$  microvolts per degree C change in ambient temperature over operating range  
**OPERATING TEMPERATURE RANGE:**  $-5$  to  $+140^\circ\text{F}$  ( $-20$  to  $+60^\circ\text{C}$ )  
**STORAGE TEMPERATURE RANGE:**  $-22$  to  $+175^\circ\text{F}$  ( $-30$  to  $+80^\circ\text{C}$ )  
**RELATIVE HUMIDITY:** 10 to 90% non-condensing  
**ZERO STABILITY:** Included in Cold junction effect  
**WARM UP TIME:** 5 seconds to rated accuracy  
**OVERLOAD PROTECTION:** 120 volts AC/DC for 30 seconds on connecting leads, in any mode  
**BATTERY LIFE:** 9 Volt Alkaline: 50 hours  
**LOW BATTERY:** "BAT" indication on LCD at 7 volts nominal, approximately 10 hours left

**OVERALL SIZE:**  $2\frac{1}{2} \times 2\frac{1}{2} \times 5\frac{1}{8}$  inches (63.5 x 66.7 x 130 mm)  
**WEIGHT:** 11.5 oz. (0.33 kg)  
**CARRYING CASE:** Included, zippered with belt loop

### SOURCE MODE

**OUTPUT IMPEDANCE:** 0.1 ohms, nominal  
**SOURCE CURRENT:** Up to 8 mA  
**OUTPUT NOISE:**  $<4$  microvolts p-p for frequencies of 10 Hz or below

### READ MODE

**INPUT IMPEDANCE:**  $>10$  Megohms  
**OPEN THERMOCOUPLE DETECTION:** 10 millisecond check pulse. Nominal threshold, 10 K Ohms. Displays "----" for open circuit  
**NORMAL MODE REJECTION:** 50/60 Hz, 50 dB  
**COMMON MODE REJECTION:** 50/60 Hz, 120 dB

## RANGES

| Type      | Degrees C           | Degrees F       | Resolution        |
|-----------|---------------------|-----------------|-------------------|
| J         | -210 to 1200        | -346 to 2192    | 1 Degree          |
|           | -100.0 to 330.0     | -148.0 to 626.0 | 0.1 Degree        |
| K         | -230 to 1372        | -382 to 2502    | 1 Degree          |
|           | -100.0 to 430.0     | -148.0 to 806.0 | 0.1 Degree        |
| T         | -260 to 400         | -436 to 752     | 1 Degree          |
|           | -100.0 to 200.0     | -148.0 to 392.0 | 0.1 Degree        |
| E         | -240 to 1000        | -400 to 1832    | 1 Degree          |
|           | -100.0 to 300.0     | -148.0 to 572.0 | 0.1 Degree        |
| N         | -196 to 1300        | -320 to 2372    | 1 Degree          |
|           | -100.0 to 426.0     | -148.0 to 800.0 | 0.1 Degree        |
| L (J-DIN) | -200 to 900         | -328 to 1652    | 1 Degree          |
|           | -100.0 to 330.0     | -148.0 to 626.0 | 0.1 Degree        |
| R         | 93 to 1768          | 200 to 3214     | 1 Degree          |
| S         | 93 to 1768          | 200 to 3214     | 1 Degree          |
| B         | 400 to 1820         | 752 to 3308     | 1 Degree          |
| C         | 0 to 1800           | 32 to 3275      | 1 Degree          |
| MV        | -500.0mV to 999.9mV |                 | 100 $\mu\text{V}$ |
|           | -50.00mV to 99.99mV |                 | 10 $\mu\text{V}$  |

### WARRANTY

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from date of shipment. Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option. The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incident or consequential damage.

### ORDERING INFORMATION

SPECIFY A T/C TYPE SCALE  
 T/C TYPE J, K, T, E, R, S, B, (Field Changeable)  
 AND SCALE: N, C, L (J-DIN) °F, °C, F/C

Model 222  
 or  
 Model 222-MV

Included: Carrying Case (09-3781)  
 NIST Certificate

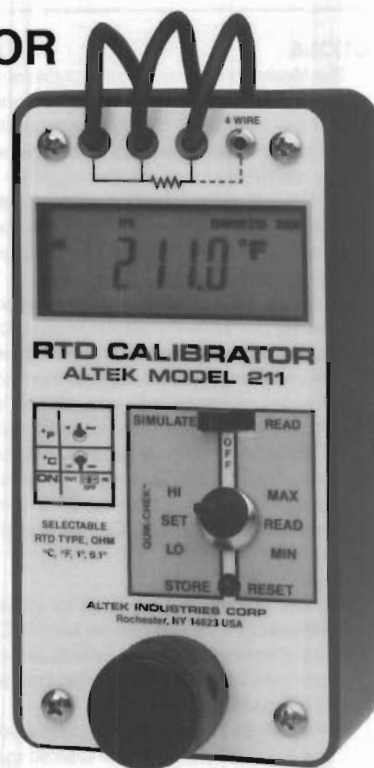
### OTHER PRODUCTS

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal. Consult our factory directly or contact your local stocking representative to order precise, low cost Milliamp Calibrators, Voltage Sources, Direct Thermocouple Sources, RTD Simulators and Frequency Sources. Altek also produces calibrators for custom ranges and unique applications. Additional models and ranges are frequently added to the Altek instrument family to meet all of your critical calibration requirements.

### AVAILABLE FROM:

## RTD CALIBRATOR MODEL 211

- **8 RTD TYPES & OHMS**  
Select Pt, Cu or Ni
- **TEMPERATURE INPUT & OUTPUT**  
Directly in degrees
- **"QUIK-CHEK™" SWITCH**  
Three points, HI, LO & Set
- **0.025% ACCURACY, 1° OR 0.1° RESOLUTION**  
Field Selectable °F or °C
- **THREE YEAR WARRANTY**  
Toolbox tough
- **CUSTOM RANGES AVAILABLE**



### GENERAL DESCRIPTION

Altek's Model 211 RTD Calibrator lets you **SIMULATE** and **READ** RTDs over the entire industrial temperature range. Use with transmitters, recorders, controllers, alarms, indicators, data acquisition and computer systems. Switch between four Platinum 100, one Pt 1000, one Cu 10, two Ni RTD curves or OHMs ranges from 0.00 to 410.00 and 0.0 to 2010.0.

Field customize the Model 211 to lock-in 1° resolution, fixed °C or °F or front selectable °F/°C operation. Read and simulate 2-Wire and automatically compensate for 3-Wire RTDs with built-in leads. A plug-in lead is supplied for 4-Wire RTD measurements.

The Model 211 turns on in the RTD type last used. Other RTD types may be selected each time the unit is turned on. If you always use one RTD curve, lock-in the selected RTD type with the internal DIP switch to prevent accidental change to an unwanted RTD type.

#### "SIMULATE" MODE ACTS LIKE AN RTD SENSOR

Resolution is 0.1° over the full range for Platinum 100 ohm RTD simulation, with 1 mA current supplied from the external device. Ohms range, at 1 mA current, provides 0.01 resolution from 0.00 to 410.00 and autoranges to 0.1 resolution from 410.0 to 2010.0. (See graph for other excitation currents).

"**QUIK-CHEK**" function stores **THREE** output temperatures for real convenience. The ALTEK Model 211 simulates key temperatures for repetitive calibrations. Turn the knob to check trip points, controller action or hysteresis. The fast response 211 sets quickly without overshoot. Memory is retained even when power is off.

The Model 211 has a unique circuit which lets you simulate RTD's with most transmitters, recorders and other RTD inputs with fixed or intermittent excitation currents.

#### "READ" MODE MEASURES RTDs DIRECTLY

The Model 211 display gives you fast, accurate temperature measurement with 0.1 and 1 degree or with 0.01 and 0.1 ohm resolution. Two, three and four wire hookups assure accuracy in long cable runs. Open RTDs and leads are detected and indicated on the LCD display. Two readings per second track fast moving temperatures.

"**MAX**" and "**MIN**" memories are continuously updated from turn-on or whenever the "**RESET**" button is pressed. Model 211 gives you a handy tool to monitor temperatures for drift or control deviation. Just flip the **QUIK-CHEK** switch to display the **MIN**imum and **MAX**imum temperature measured since reset.

#### TURN-ON SEQUENCE

Each time the Model 211 is turned on, the LCD displays all segments for 1 second. It then displays the sensor material and Alpha (ohms at 100°C/ohms at 0°C) for the currently selected RTD type for approximately 3 seconds. Any of 8 built-in RTD types and alpha values plus ohms may be selected during the RTD turn-on mode.

#### CUSTOM RANGES

Custom ranges for additional RTD types, Dew Cell or other resistive sensors are also available. The Metal, Base Resistance and Alpha value for the custom RTD curve must be specified. Adding a custom range to a 211 may require removing one of the standard ranges. Unless otherwise specified the Ni 110 (Bristol 7 NA) will be replaced with the custom range if necessary.

#### ALTEK INDUSTRIES CORP

210 Commerce Drive  
Rochester, New York 14623 U.S.A.  
(716) 334-3720  
FAX: (716) 334-6673



# OPERATING INSTRUCTIONS

## GENERAL

### CONNECTIONS



The Model 211 accurately simulates and reads 2, 3, or 4 wire RTDs. It has three leads permanently attached and a socket for a fourth wire (supplied). The LCD indicates "4-WIRE" when the fourth wire is connected. The fourth wire must only be plugged in when simulating or reading 4-Wire RTDs. All connecting wires must be the same length and of the same material running along the same path to insure maximum accuracy.

### TWO, THREE OR FOUR WIRE

Two wire RTD measurements are less accurate than other RTD measurements because of the errors introduced by the resistance of the lead wires. The third wire in a three wire hookup provides the instrumentation with a reference connection for the lead wires. The measuring instrumentation uses this reference to infer the actual resistance of the RTD element without the leads. Four wire RTD measurements take into account all wires other than the RTD sensing element. This makes four wire RTDs best suited for precision measurements.

### CHANGING RTD TYPES

Eight RTD types or ohms may be selected each time the Model 211 is turned on. An internal DIP switch may be used to disable the front panel selection to permanently lock in a single RTD type (see below).

To change RTD types:

- 1) Press & hold the STORE pushbutton while switching the unit on or while  $\alpha$  is blinking during the first 3 seconds after the unit is turned on.
  - 2) Continue to hold the STORE pushbutton. The LCD will scroll through the 8 RTD types and ohms, displaying the Sensor material and value for each RTD type.
  - 3) Release the STORE pushbutton when the desired Metal and value are displayed.
  - 4) After 2 seconds, the Model 211 will store the RTD type you selected and will begin Simulating or Reading RTD signals.
  - 5) Each additional time the Model 211 is turned on without holding the STORE pushbutton, the newly selected RTD type will be displayed and used. If an incorrect type is selected, repeat steps 1 through 3.
- Note: For Pt 100 ohm,  $\alpha = 1.3850$  the word DIN will appear on the LCD.

### OPERATING WITH INTERMITTENT EXCITATION CURRENTS

Some transmitters, recorders and other RTD input devices use intermittent, or pulsed, excitation currents to measure the resistance of the RTD. The Model 211 may be internally configured to operate with both fixed excitation currents (default operation) and with intermittent currents (see Setting Operating Mode below).

### SELECTING °F OR °C



The Model 211 may be internally configured in one of three modes. The first two modes are for full-time use in °F or full-time use in °C. The third mode allows front panel selection of °F or °C each time the unit is turned on. If your facility is completely in °F or °C, set the internal DIP switches of the 211 to operate as a dedicated °F or °C instrument (see Setting Operating Mode below).

### USING F/C MODE

In F/C mode the temperature scale is selected by setting the "QUICK-CHEK" switch before turning the unit on. Place the switch to HI/MAX to select °F or LO/MIN to select °C. If the unit is turned on with the switch in the SET/READ (center) position the temperature scale most recently used will be displayed.

Hint: The Model 211 will automatically convert the temperatures in memory between °F and °C. For example, if 212° F is stored in HI and the Model 211 is switched to °C, 100°C will be displayed.

### SELECTING AUTORANGING OR 1° RESOLUTION

The Model 211 may be internally configured to autorange or to constantly display with fixed resolution. When autoranging is selected, the Model 211 will display temperatures with 0.1° or 1° and ohms with 0.0Ω or 0.1Ω resolution. When fixed range is selected, the Model 211 will display temperatures with 1° and ohms with 0.1Ω resolution.

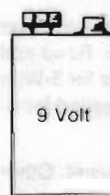
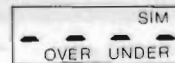
Note: Some ranges are always displayed with 1° resolution.

### OVER RANGE/UNDER RANGE

Out-of-range temperatures are indicated by - - - - and OVER or UNDER on the display during READ mode. If this occurs check for proper connections and RTD type selection. During SIMULATE mode excitation currents below 0.090mA are indicated by the word SIM flashing on the display. Excitation currents above 5.8mA are indicated by - - - - and SIM flashing on the display. Check for proper connections.

### CHANGING BATTERY

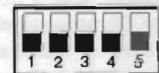
Low battery is indicated by BAT on the LCD display. Approximately 10 hours of operation remain before the LCD goes blank and the Model 211 shuts itself down. Turn the Model 211 off. Remove the four corner screws and lift the unit out of the case. The battery is fastened to the bottom printed circuit board and is easily removed.



## SETTING OPERATING MODE (DIP SWITCHES)

- 1) Turn the Model 211 OFF.
- 2) Remove the 4 corner screws and lift faceplate assembly out of the case.
- 3) Set the DIP switches for your options as diagrammed below.

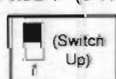
\*Factory Settings  
(All Switches Down)



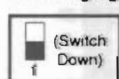
### AUTORANGING

Switches between autoranging 0.1°/1° (0.01Ω / 0.1Ω) and fixed 1° (0.1Ω).

Fixed 1° (0.1Ω)



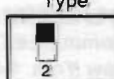
Autoranging\*



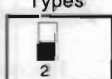
### FIXED RTD TYPE

Switches between a single RTD type and RTD type selection at turn on.

Single RTD Type



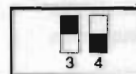
Selectable RTD Types\*



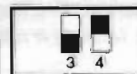
### TEMPERATURE SCALE

Switches between fixed °F, fixed °C or °C/°F selection at turn on.

Fixed °F



Fixed °C



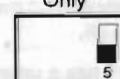
\*°C/°F Switchable\*



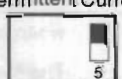
### EXCITATION CURRENT

Switches between simulating with fixed excitation currents and excitation current selection at turn on.

Fixed Current Only\*

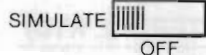


Fixed and Intermittent Currents



## SIMULATE MODE (RESISTANCE OUTPUT OR RTD TEMPERATURE EQUIVALENT)

### SIMULATE



- 1) Set up the Model 211 for the correct RTD type and temperature scale ( $^{\circ}\text{C}$  or  $^{\circ}\text{F}$ ).
- 2) Disconnect the input wires from the device to be calibrated or checked.
- 3) Connect the Model 211 to the device to be calibrated, being careful to observe proper connections for 2, 3 or 4-Wire hookups.
- 4) Adjust the digital pot to the desired output value.

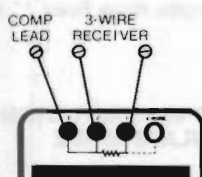
### OUTPUT



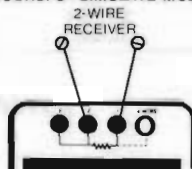
Whenever SIMULATE mode is selected the word SIM will appear on the LCD. SIM will flash when the Model 211 is measuring the external excitation current and will be steady when accurately simulating a resistance. To change the output value, turn the speed sensitive digital pot. Turning the pot slowly will cause a gradual change in the output. A faster change will occur when the pot is turned too fast. This function operates in all three output positions (HI, SET & LO).

**NOTE:** SIM flashing on the LCD indicates that the excitation current is missing, out of range or is intermittent. Check to see that the device being calibrated has operating power and that the 211 is properly connected. Also check the manual for the device to make sure that the excitation current is in the range of 0.090 to 5.800 milliamps.

**Hint:** Some "smart" transmitters and scanning recorders or indicators use intermittent currents to measure RTD's. Try putting recorders into a calibrate mode or lock them into one channel. The Model 211 can be configured to accept intermittent excitation with minimum 125 msec fixed current at a minimum repetition rate of 1/sec (see OPERATING WITH INTERMITTENT EXCITATION CURRENTS).



HOOKUPS - SIMULATE MODE



### STORE



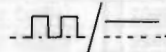
- 1) Switch to HI (or LO).
- 2) Turn the digital pot to desired value.
- 3) Press STORE.

If a value is in the SET position and you want that value in HI or LO, press and hold the STORE button while moving the switch to HI or LO. Then release the STORE button. When there is no excitation current or the current is less than  $90\mu\text{A}$ , SIM will flash on the LCD. "QUIK-CHEK" values may still be stored with SIM flashing.


### "QUIK-CHEK"

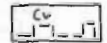
Any time you need a stored value just throw the "QUIK-CHEK" switch. Any value in the RTD range may be stored in HI & LO. The Model 211 remembers the HI, LO and SET values for you with the power on or off. The resolution of the stored value will be based on the excitation from the receiver. When a new RTD type is selected, the resistance of the sensor at  $0^{\circ}\text{C}$  is stored in all "QUIK-CHEK" positions. When the ohms range is selected, 100 will be the initial setting for all "QUIK-CHEK" positions.

### SELECTING FIXED/INTERMITTENT CURRENT



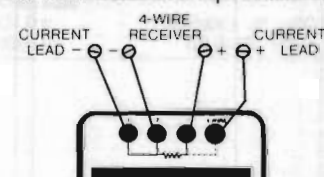
Operation with fixed or intermittent currents may be chosen after the unit is turned on and the RTD type has been selected.

Fixed currents are indicated by 

Intermittent currents are indicated by 

To keep the excitation selection: Wait 3 seconds

To change the excitation selection: Press the STORE pushbutton  
Note: Cu indicates Current while selecting fixed or intermittent currents.  
Hint: Choose intermittent excitation *only* when device to be calibrated uses intermittent currents. Most devices require that fixed current operation is selected.



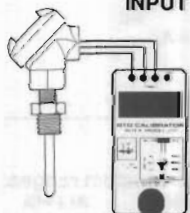
## READ MODE

### READ



- 1) Set up the Model 211 for the correct RTD type and temperature scale ( $^{\circ}\text{C}$  or  $^{\circ}\text{F}$ ).
- 2) Disconnect the wires from the resistance sensor to be read or checked.
- 3) Connect the Model 211 to the sensor to be measured, being careful to observe proper connections for 2, 3 or 4-Wire hookups.
- 4) Display present reading, Maximum or Minimum temperature.

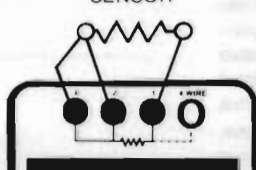
### INPUT



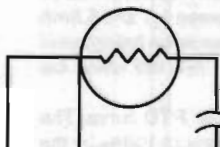
Whenever READ mode is selected the word READ will appear on the LCD. The Model 211 can measure temperatures in two ranges with resolution of  $0.1^{\circ}$  and  $1^{\circ}$ . The display is updated twice per second to continuously track fast moving temperatures. Using three or 4-Wire hookups provides accurate readings in long cable runs.

HOOKUPS - READ MODE

2-WIRE RTD SENSOR



### OPEN RTDS

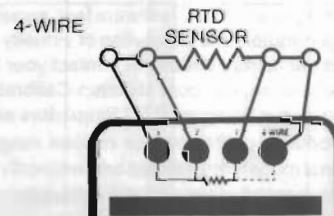
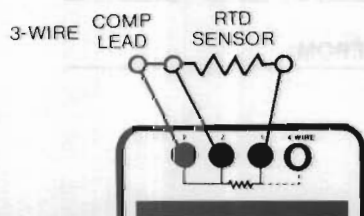


The Model 211 checks for open or high resistance connections. Open or burned out RTDS are indicated by - - - - on the display. Temperatures out of range for the RTD selected will be indicated by OVER and UNDER on the display.

### MIN/MAX



To read the Maximum or Minimum temperature since READ mode was entered, simply switch to MAX or MIN. The value will appear on the LCD along with the word MAX or MIN. The MAX/MIN values are automatically updated and may be viewed at any time without disturbing the other values. Pressing RESET will transfer the present temperature into both MAX and MIN and will update them as the measured temperature changes.



## SPECIFICATIONS

(Unless otherwise specified, specifications are in % of Span in ohms at 1.0 mA excitation current @ 25° C

### GENERAL

ACCURACY:  $\pm 0.025\%$ ;  $\pm 0.013\%$  Typical  
 TEMPERATURE DRIFT:  $\pm 0.01\%$  /°C  
 OPERATING TEMPERATURE RANGE: -5 to +140° F (-20 to +60° C)  
 STORAGE TEMPERATURE RANGE: -22 to +175° F (-30 to +80° C)  
 RELATIVE HUMIDITY: 10 to 90%, non-condensing  
 WARM UP TIME: 30 seconds to maximum accuracy  
 OVERLOAD PROTECTION: Electronically protected to 40 VDC between leads 1 & 2, fuse protected to 125 VAC, 5A between leads 2 & 3 and between leads 1 & 4  
 BATTERY LIFE: 9 Volt Alkaline: 50 hours  
 LOW BATTERY: "BAT" indication on LCD at 7 Volts nominal, approximately 10 hours left  
 OVERALL SIZE: 2 1/2 x 2 5/8 x 5 1/8 inches (63.5 x 66.7 x 130 mm)  
 WEIGHT: 11.5 oz. (0.33 kg)  
 CARRYING CASE: Included, zippered with belt loop

### SOURCE MODE (SIMULATION OF RESISTANCE OUTPUT)

OUTPUT RESISTANCE RANGE: 0.00 to 2010.0 Ohms  
 ALLOWABLE EXTERNAL EXCITATION CURRENT: 0.090 to 5.800mA, DC  
 INTERMITTENT EXCITATION CURRENT MODE: Accepts intermittent excitation currents with minimum 125 msec fixed current at minimum repetition rate of 1/sec from 0.090 to 5.800mA

### READ MODE (MEASUREMENT OF EXTERNAL RTD)

EXCITATION CURRENT SUPPLIED: 1 mA, nominal  
 NORMAL MODE REJECTION: 50/60 Hz, 50 db  
 COMMON MODE REJECTION: 50/60 Hz, 100 db

Specifications subject to change without notice

## TYPES, RANGES, RESOLUTION AND ACCURACY

| RTD TYPE                  | ALPHA  | DEGREES C       |                  | DEGREES F        |                  |
|---------------------------|--------|-----------------|------------------|------------------|------------------|
|                           |        | RANGE           | TYPICAL ACCURACY | RANGE            | TYPICAL ACCURACY |
| Pt 100 (DIN/IEC/JIS 1989) | 1.3850 | -200.0 to 850.0 | $\pm 0.15$       | -328.0 to 1562.0 | $\pm 0.25$       |
| Pt 100 (Old JIS 1981)     | 1.3916 | -200.0 to 648.0 | 0.15             | -328.0 to 1200.0 | 0.25             |
| Pt 100 (Burns)            | 1.3902 | -195.0 to 648.0 | 0.15             | -320.0 to 1200.0 | 0.25             |
| Pt 100 (US Lab)           | 1.3926 | -200.0 to 862.0 | 0.15             | -328.0 to 1584.0 | 0.25             |
| Pt 1000 (HVAC)*           | 1.3750 | -184 to 275     | 0.10             | -300 to 527      | 0.15             |
| Cu 10 (Minco)*            | 1.4274 | -200 to 260     | 1.10             | -328 to 500      | 2.00             |
| Ni 120 (Pure)             | 1.6720 | -80.0 to 273.0  | 0.10             | -112.0 to 524.0  | 0.15             |
|                           |        | 273 to 316      | 0.10             | 524 to 600       | 0.15             |
| Ni 110 (Bristol 7 NA)     | 1.5801 | -105.0 to 310.0 | 0.10             | -160.0 to 600.0  | 0.20             |

| OHMS | RANGE | ACCURACY                      | TYPICAL ACCURACY              |
|------|-------|-------------------------------|-------------------------------|
|      |       | $\pm 0.10\%$<br>0.50 $\Omega$ | $\pm 0.05\%$<br>0.25 $\Omega$ |

\*These ranges have fixed 1° resolution

**Note:** Above ranges are for READ mode in which the Model 211 provides a 1 mA excitation current. SIMULATE mode operates in these ranges with external excitation currents between 0.090 and 1.1 mA. Resolution will be 1°, or 0.10 $\Omega$ , in all ranges for excitation currents between 1.1 and 5.8mA 1000 $\Omega$  RTDs: The maximum excitation current to source the full range of the Pt 1000 1.375 is 1 mA. Currents exceeding 1 mA will lower the maximum temperature.

The symbol Alpha ( $\alpha$ ) is used to identify the particular RTD curve. The value is derived by dividing the resistance of the sensor at 100°C by the resistance at 0°C ( $\alpha = R_{100^\circ C}/R_{0^\circ C}$ ). For Pt 100 DIN/IEC/JIS this is 138.50/100.00 = 1.3850 (which is also shown as 0.00385).

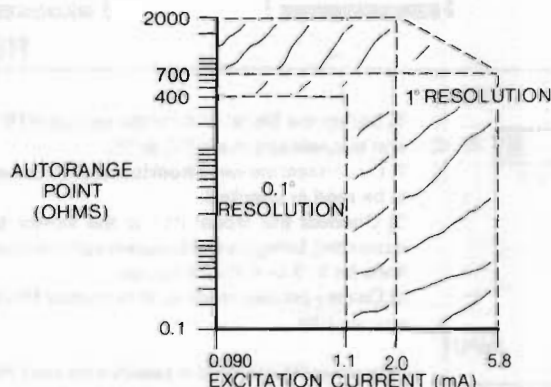
### THREE YEAR WARRANTY

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from date of shipment. Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option. The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incidental or consequential damage.

### OTHER PRODUCTS

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal. Consult our factory directly or contact your local stocking representative to order precise, low cost Milliamp Calibrators, Voltage Sources, Direct Thermocouple Sources, RTD Simulators and Frequency Sources. Altek also produces calibrators for custom ranges and unique applications. Additional models and ranges are frequently added to the Altek instrument family to meet all of your critical calibration requirements. Altek products are made in the USA.

### AUTORANGE POINT VS. EXCITATION CURRENT SIMULATE MODE



### ORDERING INFORMATION

MODEL 211  
 Carrying Case included (Part # 09-3781)  
 Use the format below only for ordering 211's with custom ranges.

CUSTOM 211 —  METAL —  BASE RESISTANCE —  ALPHA — 1.

AVAILABLE FROM:



## ALTEK

- **DIRECT TEMPERATURE OUTPUT**  
11 Switched Steps
- **0.1°C ACCURACY**  
25, 50, OR 100 Degree Resolution
- **"QUIK-CHEK"™ SWITCH**  
Replaces Decade Box
- **ALL MANUFACTURERS RTD CURVES**  
Platinum, Nickel, Copper & Nickel-Iron

ALTEK SERIES 11 Resistance Bulb (RTD) Simulators provide 11 precise temperatures for inputs to transmitters, recorders, controllers, alarms, data acquisition and computer systems. Model 11 allows 2, 3 or 4 wire connections. Factory calibration includes compensation for the resistance of the built-in lead wires. Conformity to the particular RTD curve is in accordance with the latest standards for exact temperature simulation.

Platinum, Nickel and copper calibrations are available in both degrees F and C. The table lists the standard ranges, other ranges and curves are available options. Resolution is 25, 50 or 100 degrees, corresponding to full scale output of 250, 500, and 1000 degrees respectively.

Positive switch selection allows quick, easy settings for any output. Calibrated accuracy for most models is  $\pm 0.1^\circ\text{C}$ .

The low cost ALTEK MODEL 11 is a complete compact simulator for checkout and calibration of all RTD instruments in the field, shop or control room.

### SPECIFICATIONS

(Unless otherwise specified, specifications are at  $25^\circ\text{C}$ )

#### ACCURACY:

- Pt 100 Ohm  $\pm 0.1^\circ\text{C}$  ( $\pm 0.2^\circ\text{F}$ )
- Ni 120 Ohm  $\pm 0.1^\circ\text{C}$  ( $\pm 0.2^\circ\text{F}$ )
- NiFe 604 Ohm  $\pm 0.1^\circ\text{C}$  ( $\pm 0.2^\circ\text{F}$ )
- Cu 10 Ohm  $\pm 1.0^\circ\text{C}$  ( $\pm 2.0^\circ\text{F}$ )

TEMPERATURE DRIFT:  $\pm 0.01\%/^\circ\text{C}$

ALLOWABLE EXCITATION CURRENT: 0 to 15 milliamps, steady or intermittent

OPERATING TEMPERATURE RANGE:  $-25$  to  $55^\circ\text{C}$  ( $-10$  to  $+130^\circ\text{F}$ )

STORAGE TEMPERATURE RANGE:  $-40$  to  $70^\circ\text{C}$  ( $-40$  to  $180^\circ\text{F}$ )

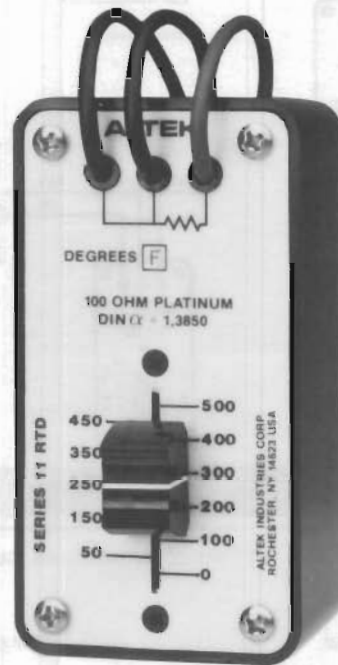
RELATIVE HUMIDITY: 10 to 90%, non-condensing

SIZE:  $2\frac{1}{8} \times 4 \times 2\frac{1}{4}$  inches ( $54 \times 102 \times 55$  mm)

WEIGHT: 3 ounces (0.12 kg)

OPTIONAL CARRYING CASE: Zippered with belt loop

Specifications subject to change without notice



### OPERATING INSTRUCTIONS

Select the ALTEK MODEL 11 for correct RTD type and curve, the desired temperature scale (F or C), and range. Connect the ALTEK RTD SIMULATOR leads tightly to the input terminals of the instrument to be tested, the field mounted head or the junction box terminals. Set the temperature selection switch to the desired temperature. End point calibration temperatures of the instrument are then selected on the MODEL 11 and any required adjustments are made. Intermediate points may be selected to verify instrument linearity or check critical points.

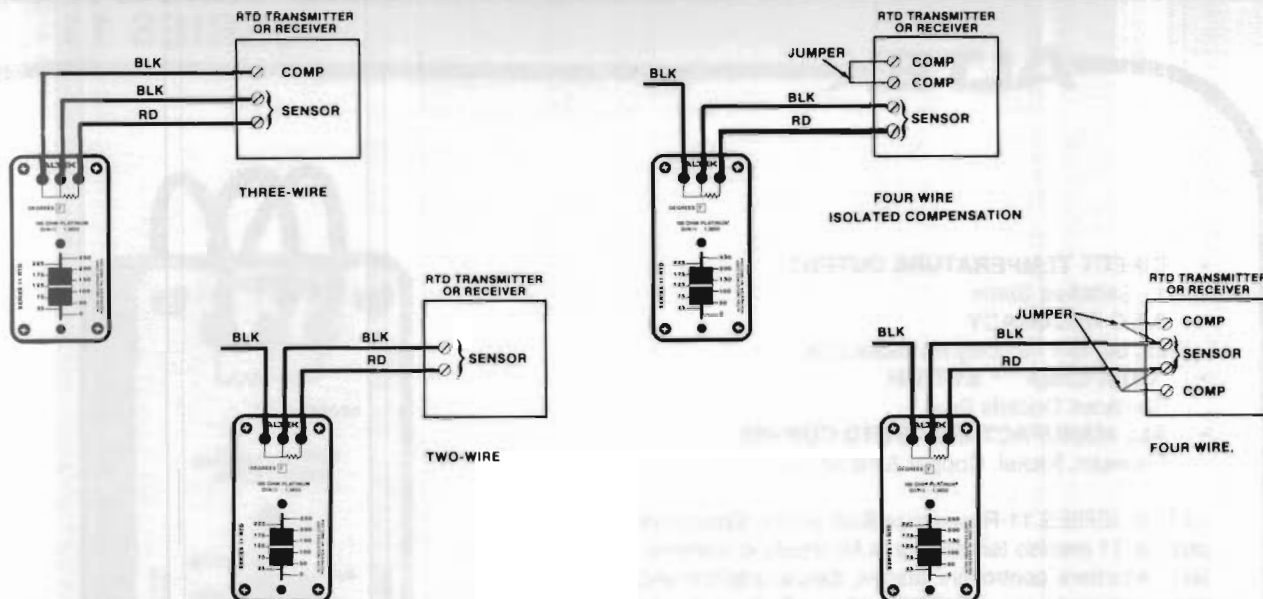
### THREE YEAR WARRANTY

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from the date of shipment. Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option. The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incidental or consequential damage.

### ALTEK INDUSTRIES CORP.

210 Commerce Drive  
Rochester, New York 14623 U.S.A.  
(716) 334-3720  
FAX: (716) 334-6673

## CONNECTION INFORMATION



## ORDERING INFORMATION

### STANDARD RANGES - 11 equal temperature steps

#### Platinum (Pt)

##### Order Model

11-Pt 100-(\*) -250F  
 11-Pt 100-(\*) -250C  
 11-Pt 100-(\*) -500F  
 11-Pt 100-(\*) -500C  
 11-Pt 100-(\*) -1000F

Curve or Alpha ( $\alpha$ ) Value

##### \* Insert Curve or Alpha ( $\alpha$ ) Value

\*1.3850 DIN/IEC 751, DIN 43760, JIS 1604-1989  
 \*1.3902 US Industrial, Burns  
 \*1.3916 JIS 1604-1981  
 \*1.3926 US Laboratory  
 \*1.375 HVAC, Hy-Cal for Pt 1000 Ohm

##### \* Insert Curve or Alpha ( $\alpha$ ) Value

If not specified, Alpha=1.3850

Example: 11-Pt100-1.3850-500F

Contact ALTEK for Pt 200, 500 & 1000 Ohm Ranges

#### Copper (Cu), Nickel (Ni), Nickel-Iron (NiFe)

##### Order Model

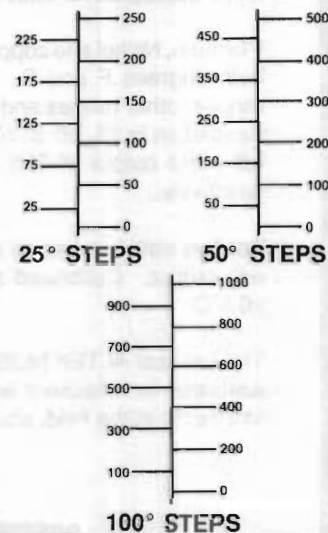
11-(\*) -250F  
 11-(\*) -250C  
 11-(\*) -500F

\* Insert Material

##### Material

{ Cu 10 Ohm Minco 16-9  
 { Ni 120 Ohm US Industrial  
 { NiFe 604 Ohm

### STANDARD SCALES



### CUSTOM RANGES - Any 11 temperatures for any RTD

| Material Type | Nominal Resistance | Curve or Alpha ( $\alpha$ ) Value | Scale °C or °F | Temperature Points |   |   |   |   |   |   |   |   |    |    |
|---------------|--------------------|-----------------------------------|----------------|--------------------|---|---|---|---|---|---|---|---|----|----|
| MODEL 11-     | OHM                | 1.                                |                | 1                  | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |

Example: MODEL 11-Pt-500 OHM-1.3902-DEGREES C - -100, -50, -40, -21, 0 100, 250, 260, 275, 500

Custom Model 11 RTD Simulators may be ordered for RTD's of any material, nominal resistance or curve. Any 11 temperature points may also be chosen. Material, Nominal resistance, curve, scale and the 11 temperatures must be specified.

### OTHER PRODUCTS

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal. Consult our factory directly or contact your local stocking representative to order precise, low cost Milliamp Calibrators, Voltage Sources, Direct Thermocouple Sources, RTD Simulators and Frequency Sources. Altek also produces calibrators for custom ranges and unique applications. Additional models and ranges are frequently added to the Altek Instrument family to meet all of your critical calibration requirements. Altek products are made in the USA.

### AVAILABLE FROM:

# THERMOCOUPLE SOURCE SERIES 22

## ALTEK

- **DIRECT TEMPERATURE OUTPUT**  
22 Precise Steps
- **0.1% ACCURACY**  
25, 50 or 100 degree resolution
- **DESIGNED FOR INTRINSIC SAFETY**  
Field, shop and control room use
- **POCKET SIZED**  
1 Year Battery Life
- **MODELS FOR TYPES B, E, J, K, R, S, T;**  
°C & °F Cold-Junction Compensated

ALTEK SERIES 22 Thermocouple Sources provide 22 precise temperatures for inputs to transmitters, recorders, controllers, alarms, data acquisition and computer systems. Model 22 provides thermocouple wire output and is cold-junction compensated for ambient temperature variations. Conformity to the particular thermocouple vs millivolt curve is in accordance with the latest ASTM and IPTS standards for exact temperature simulation. Linear millivolt models are also available.

Thermocouple types B, E, J, K, R, S and T are available in both degrees F and C. The table lists the standard ranges. Resolution is 25, 50 or 100 degrees, corresponding to full scale output of 500, 1000, 1700, 2100 and 3100 degrees respectively.

Dual ranges, with an individual "ON" position for each range, allow quick, easy settings for any output. Calibrated accuracy is  $\pm 0.1\%$  of span  $\pm 1$  degree. Negative temperatures add  $\pm 2$  degrees.

Two built-in AA cells provide power for one year of everyday use. A front panel LED pulses every time the Model 22 is turned on to indicate proper battery voltage.

The low cost ALTEK MODEL 22 is a complete, compact source for checkout and calibration of all thermocouple instruments in the field, shop or control room.

#### WARRANTY:

Our equipment is guaranteed against defective material and workmanship for a period of three years from date of shipment.

Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option.

The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incident or consequential damage.



#### OPERATING INSTRUCTIONS

Select the ALTEK MODEL 22 for the correct thermocouple type, the desired temperature scale (F or C), and range.

Connect the ALTEK Thermocouple Source to the input terminals of the instrument to be tested, the field mounted head or junction box terminals.

Cold-junction compensation and instantaneous automatic standardization is built into the Model 22.

Set the temperature selection switch to the desired temperature and slide the "ON" switch to the selected scale. The Battery Check LED will pulse once indicating proper battery voltage. If no pulse is seen, the batteries should be replaced with 2 "AA" cells. Alkaline cells are preferred for longest life and widest operating temperature range.

End point calibration temperatures of the instrument are then selected on the Model 22 and any required adjustments are made. Intermediate points may then be selected to verify instrument linearity or check critical points.

#### ALTEK INDUSTRIES CORP.

210 Commerce Drive  
Rochester, New York 14623 U.S.A.  
(716) 334-3720  
FAX: (716) 334-6673

DATA SHEET 22



## SPECIFICATIONS

### Accuracy:

$\pm 0.1\%$  of span  $\pm 1$  degree. Negative temperatures add  $\pm 2$  degrees.

### Cold Junction Compensation:

Built-in for specified thermocouple type

### Cold Junction Temperature Effect:

Within  $\pm 0.25$  degree at  $75^\circ\text{F}$  ( $20^\circ\text{C}$ )  $\pm 0.025$  degrees/degree change in ambient

### Operating Ambient Temperature:

Minus 10 to  $+130$  degrees F (Minus 25 to  $+55$  degrees C)

### Ambient Temperature Effect:

Zero: included in cold junction effect

Span:  $\pm 0.01\%$  of span/degree

### Storage Temperature Limits:

Minus 40 to  $+160$  degrees F (Minus 40 to  $+70$  degrees C)

### Output Impedance:

Fixed, 50 ohms nominal

### Batteries:

2 AA alkaline cells provide 1 year of use at 4 hours each workday

### Battery Indicator:

LED light pulse at turn-on in either range

### Size:

$2\frac{1}{2} \times 4 \times 2\frac{1}{4}$  inches (54 X 102 X 55 mm)

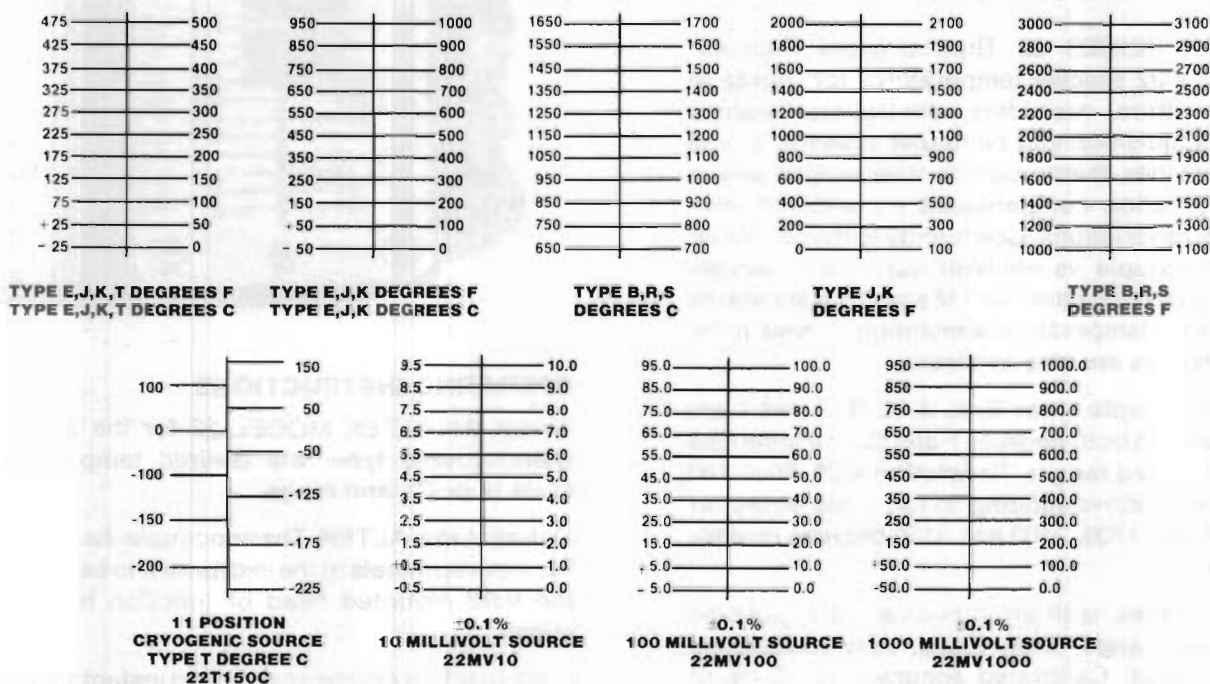
### Weight:

6 oz. (0.15 kg)

### Optional Carrying Case:

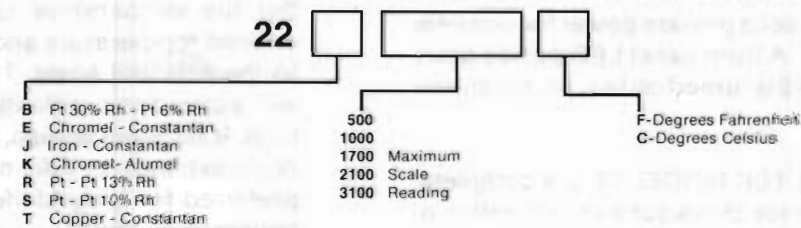
Zippered, with belt loop

## SERIES 22 STANDARD RANGES (FOR OTHER RANGES & TC TYPES CONSULT FACTORY)



## ORDERING INFORMATION:

Specify thermocouple type, scale range and  $^\circ\text{F}$  or  $^\circ\text{C}$  to insure prompt delivery of all the above standard ranges. A 22J 1000F completely describes an Altek 22 position source providing a maximum output of 1000  $^\circ\text{F}$  for a type J thermocouple. For millivolt output specify 22 MV10, 22 MV100, or 22 MV1000.



## PRINCIPLE OF OPERATION:

Altek Series 22 Thermocouple and millivolt sources are self contained, high precision instruments which provide direct signals for the calibration of thermocouple or millivolt devices of all types.

Output signal is controlled by an 11 position switch which operates in 2 interleaved ranges, providing 22 precisely fixed outputs corresponding to the standard table millivolt values of the temperatures selected. Internally, the switch is connected to a thin film voltage divider which is linearized for the particular thermocouple type, scale and range. The divider is driven by an ultra stable reference operating at a level 10 times higher than the output signal to reduce drift and internal thermal effects to negligible levels.

The selected voltage is applied to the input of a precision operational amplifier which controls an output darlington. Current passes through the darlington in series with a stable feedback resistor. Feedback voltage is connected to the balancing terminal of the operational amplifier to automatically keep the output millivolts at exactly the desired value.

Cold junction compensation is provided by a temperature sensitive current source which is set for exact compensation of ambient temperature variation for the particular thermocouple type. Power is provided by 2 AA cells with an average current drain of 1.5 ma when on. The Series 22 will operate down to 1/2 battery voltage, which provides more than 1000 hours of continuous duty with alkaline cells.

## OTHER PRODUCTS

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal. Consult our factory directly or contact your local stocking representative to order precise, low cost Milliamp Calibrators, Voltage Sources, Direct Thermocouple Sources, RTD Simulators and Frequency Sources. Altek also produces calibrators for custom ranges and unique applications. Additional models and ranges are frequently added to the Altek instrument family to meet all of your critical calibration requirements.

# ALTEK

## INDUSTRIAL FREQUENCY CALIBRATOR SOURCES - READS - AVERAGES

- PROCESS CONTROL RANGES
- 3 CYCLES/HOUR TO 200 KHz
- TOOLBOX TOUGH
- "QUIK-CHEK™" SWITCH

### DESIGNED FOR INDUSTRY

Chemical Plants  
Refineries  
Food Processing  
Pipelines  
Utilities  
Water & Waste Treatment  
Public Works  
Steel Mills  
Paper Mills  
Textile Mills  
Automotive Plants  
Aerospace  
Pharmaceutical  
Glass & Ceramics  
Metrology  
Beverages  
Plastics  
Machinery  
Ordinance



### APPLICATIONS

#### FREQUENCY OUTPUT SOURCE MODE

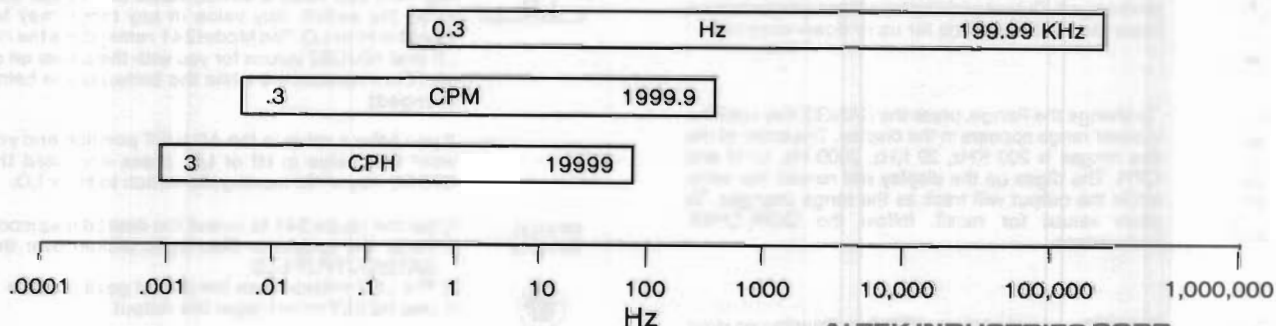
For low frequency applications such as positive displacement flowmeters, Watt-hour meters, slow rate integrators and assembly line counting, the Model 241 sources signals as slow as 0.3 Counts per Minute (0.005 Hz) and 3 Counts per Hour (0.00083 Hz) in the period ranges.

Any frequency from 0.3 Hz to 163.83 KHz can be sourced in three frequency ranges to calibrate tachometers, counters, data loggers, turbine flowmeters and frequency transmitters. Frequency receivers that provide DC power to pickups can also be calibrated. Four decade adjustments allow speedy, precise setting of output frequency.

#### FREQUENCY COUNTER READ MODE

To calibrate devices that require extremely low frequencies (< 1 Hz) the Model 241 reads signals as slow as 4 Counts per Minute (0.0666 Hz) and 120 Counts per Hour (0.0333 Hz) in the period ranges. Period ranges allow you to measure low frequencies without using a stopwatch and events counter or totalizer. You can now calibrate integrators, energy monitors and any other low frequency processes in minutes.

Frequencies can be directly measured from 0.1 Hz to 199.99 KHz in three frequency ranges. V to F converters, accelerometers, velocity detectors, flowmeters and magnetic pickups can all be checked and calibrated.



**ALTEK INDUSTRIES CORP**  
210 Commerce Drive  
Rochester, New York 14623 U.S.A.  
(716) 334-3720  
TELEX 706189 ALTEK ROC UD

## GENERAL DESCRIPTION

### FIVE REAL-WORLD RANGES

Counts-per-Hour  
Counts-per-Minute  
2000 Hertz  
20 kilohertz  
200 kilohertz

### "QUIK-CHEK" SWITCH

Store three values for instant recall

### MEASURE AND AVERAGE

0.1 Hz to 200 Hz  
4 CPM to 20,000 CPH

### ZERO BASE AND ZERO CENTER

Choose the output to match your process

### PHASE LOCK LOOP

Locks on high stability crystal

ALTEK'S Handheld Model 241 Frequency Calibrator combines an ultra stable frequency source with a 4½ digit, laboratory accurate counter.

The Model 241 is ideal for calibrating turbine meters, frequency counters, tachometers, vortex shedders, integrators and any other frequency devices in the shop, plant or field. Three frequency ranges measure from 0.1 Hz to 199.99 KHz with resolution down to 0.1 Hz. Two unique period ranges measure from 4.0 to 1999.9 Counts per Minute and 120 to 19999 Counts per Hour. Quickly indicate process signals... no more waiting around with stopwatch and calculator.

A single 9 Volt alkaline battery provides more than 50 hours of output into high impedance loads.

An optional AC adaptor may be plugged into the jack on the faceplate. The adaptor can be used when the battery is low or for continuous bench and field use.

SOURCE MODE output provides a choice of Zero Based or Zero Crossing square waves. Amplitude is continuously adjustable from millivolts to over 12 Volts peak-to-peak. Each decade is adjusted individually for fast setting. A continuous ramp is provided by holding any up or down key. User adjustable QUIK-CHEK switch stores instant HI and LO outputs in any range. Third value stores automatically in ADJUST position. LED pulses with the output for calibration of optical and fiber optic devices. All ranges and values are retained in any mode of operation... even with the power off.

READ MODE utilizes a rising edge detection circuit for precise readings. Square, sine, triangle or complex waveforms can be measured. Frequency measurement gate times are selected for maximum resolution. Period measurements of Counts-per-Minute and Counts-per-Hour measure the time between successive rising edges for accurate reading every time. AVERAGE Key selects a rolling average of five readings. Dual purpose attenuator system allows adjustment of trigger level for reading true signals, not noise. Signals from less than 30 mV to 240 V peak-to-peak can be measured.

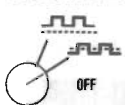
HIGH ACCURACY is maintained using an ultra stable crystal and phase lock loop circuitry. All functions are under microprocessor control for reliable operation.

SELF DIAGNOSTICS are built into the Model 241. If the microprocessor detects any discrepancy between the value displayed and the actual output frequency, ERROR will be indicated on the LCD. Turn the unit off and back on and check the display. If ERROR appears again, service is required.

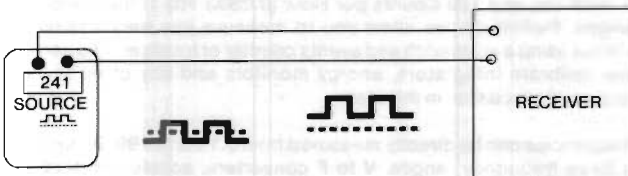
## OPERATING INSTRUCTIONS

### SOURCE MODE

#### SOURCE



- 1) Disconnect one or both input wires from the device to be calibrated or checked
- 2) Turn power on the Model 241 for either Zero Crossing or Zero Based output
- 3) Set the OUTPUT LEVEL with the Slide Potentiometer
- 4) Press the RANGE Key until the desired range appears in the display
- 5) Press the  $\blacktriangle$  or  $\blacktriangledown$  Key for each Digit to select the desired value
- 6) Connect the Model 241 to the device to be calibrated



#### OUTPUT



To change the output frequency, press the up or down key which corresponds to the minimum digit to be changed. Output and display will carry to (or borrow from) the next decade(s) for up or down ramping.

#### RANGES



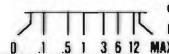
To change the Range, press the RANGE Key until the desired range appears in the display. The order of the five ranges is 200 KHz, 20 KHz, 2000 Hz, CPM and CPH. The digits on the display will remain the same while the output will track as the range changes. To store values for recall, follow the QUIK-CHEK instructions.

#### PERIOD RANGES



Select Counts-per-Minute (CPM) or Counts-per-Hour (CPH) ranges to generate low frequencies. Frequencies as low as 0.3 CPM (0.005 Hz) and 3 CPH (0.00083 Hz) can be sourced.\*

#### OUTPUT/TRIGGER LEVEL



Adjust the OUTPUT LEVEL slide pot to the value required by the receiver. Any value from 50 mV to over 12 Volts p-p may be set. The output level will remain fixed over the entire frequency range.

#### RAMPING



Each decade (1's, 10's, 100's & 1000's) can be ramped at a rate of 4 digits per second by pressing the  $\blacktriangle$  or  $\blacktriangledown$  Key for that digit. Holding any key will cause a continuous ramp. Output and display will carry to (or borrow from) the next decade(s) for smooth ramping.

#### RESET



Output pulses can be stopped and re-initiated by using the RESET Key. Pressing and holding the RESET Key halts the output. Releasing the RESET Key will enable the next rising pulse. Maximum delay is one period. This is especially useful when sourcing low frequencies (< 1 Hz).

#### QUICK CHECK



- 1) Switch to HI (or LO).
- 2) Select RANGE and press  $\blacktriangle$ / $\blacktriangledown$  Keys to desired value
- 3) Press STORE

Any time you need a stored value and range, just throw the switch. Any value in any range may be stored in HI or LO. The Model 241 remembers the HI, LO and ADJUST values for you with the power on or off. (Even remembers while the batteries are being changed.)

If you have a value in the ADJUST position and you want that value in HI or LO, press and hold the STORE Key while moving the switch to HI or LO.

#### OPTICAL DEVICES



- 1) Set the Model 241 to output the desired frequency
- 2) Place the optical or fiber optic pickup over the GATE/OUTPUT LED
- 3) The LED pulses when the output goes positive
- 4) Use RESET to re-trigger the output

#### OUTPUT

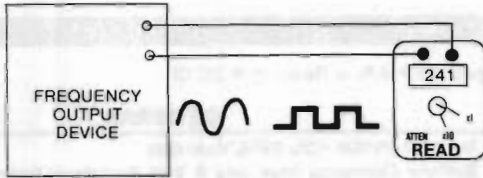


# OPERATING INSTRUCTIONS

## READ MODE



- 1) Turn power on with ATTENUATOR at x10 for signals from 12 to 120 Volts p-p or x1 for signals from 30 mV to 12 Volts p-p
- 2) Press the RANGE Key until the required range appears in the display
- 3) Connect the Model 241 to the device to be measured
- 4) Adjust the TRIGGER LEVEL slide pot until gate LED lights and stable readings are obtained
- 5) Press AVERAGE to start a rolling average of five readings, if desired



### PERIOD READINGS



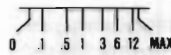
Select Counts-per-Minute (CPM) or Counts-per-Hour (CPH) ranges to measure the time between rising edges and compute the long term reading. Two periods are measured for CPM and one period for CPH. Frequencies as low as 4 CPM (0.0666 Hz) and 120 CPH (0.0333 Hz) can be measured.\*

### AVERAGE

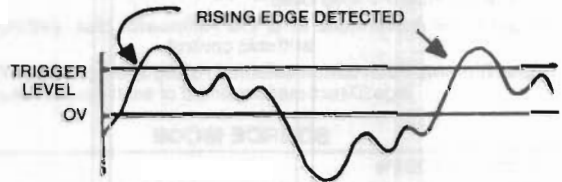


Press the AVERAGE Key to start a rolling average of five readings. After the first five readings have been averaged, each new measurement is averaged with the preceding four and displayed. Press RESET to start a new average at the next rising edge. To cancel averaging, press the AVERAGE Key again.

### OUTPUT/TRIGGER LEVEL



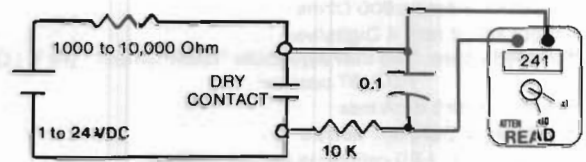
The continuously adjustable TRIGGER LEVEL is used in measurement of noisy signals, AC signals superimposed on DC levels, and to select Voltage threshold for all other signals. TRIGGER LEVEL scale reads 0 to over 12 Volts with ATTEN at x1. The scale should be read as 0 to over 120 Volts with ATTEN at x10. For quickest readings, determine or estimate the Voltage level to be detected and set the ATTENUATOR and TRIGGER LEVEL to match.



The LED will light after detecting the first rising edge to indicate GATE and stays lit until the first reading is displayed. Until the next rising edge is detected, the display will indicate the previous reading. Pressing and releasing RESET will clear the display and enable a new GATE. If the next rising edge is not detected within 30 seconds, the display will change to "0.0". Out-of-range frequency inputs are indicated by OVER or UNDER on the LCD.

### READING CONTACTS

Isolated dry contact, open collector transistor or opto-isolated frequencies may be measured with the Model 241. In order to detect contact opening or closing, an external 1 1/2 Volt battery, in series with a 1000 to 10,000 Ohm resistor, may be used. Select connection polarity to provide desired signal upon contact transfer. Relay or switch contacts may require a resistor-capacitor filter in order to eliminate contact bounce errors. Typical filter values for mechanical contacts are 10 K Ohms and 0.1 microfarads.



## OPERATING HINTS

### READ MODE

In order for the Model 241 to obtain the most accurate readings you must correctly set the ATTENUATOR, INPUT LEVEL and RANGE. Signals from 30mV to over 120 Volts p-p, with or without DC offsets can be displayed.

| SYMPTOM                           | CHECK       | SOLUTION  |
|-----------------------------------|-------------|---|
| Gate LED unlit, Display shows 0.0 | Connections | Make sure all power and signals are properly connected.   |
|                                   | Attenuator  | Set at x1 for signals from 30 mV to 12 Volts p-p, x10 for signals over 12 Volts p-p.            |
|                                   | Input level | Adjust slide pot until GATE LED pulses and readings are displayed.                              |
|                                   | DC Offset   | Small signals with large DC offsets may require a series capacitor.                             |
| Over/Under Range indicated        | Range       | Press the RANGE Key until the correct range appears in the LCD.                                 |
| Unstable reading                  | Input level | Adjust slide pot until stable readings are displayed.   |
|                                   | Average     | Press AVERAGE Key to start a rolling average of five readings. Press again to cancel averaging. |

### SOURCE MODE

Some receivers can only detect signals that go from positive to negative (Zero Crossing) while other receivers require only positive signals (Zero Based). The Model 241 provides a choice of these outputs.

| SYMPTOM                            | CHECK                 | SOLUTION  |
|------------------------------------|-----------------------|---|
| Lack of Response                   | Connections           | Make sure all power and signals are properly connected.   |
|                                    | Source switch setting | Switch to Zero Based or Zero Crossing.  |
| Wrong Range                        | Range                 | Press the RANGE Key until the correct range appears in the LCD.                                       |
| Lack of response or jittery signal | Peak Voltage          | Adjust the OUTPUT LEVEL slide pot up or down to match the input level of the device being calibrated. |

### \* CONVERSIONS

| To Convert | From: | To: | Divide By   |
|------------|-------|-----|-------------|
|            | CPM   | Hz  | 60          |
|            | CPH   | Hz  | 3600        |
| To Convert | From: | To: | Multiply By |
|            | Hz    | CPM | 60          |
|            | Hz    | CPH | 3600        |

## TYPICAL APPLICATIONS

|                                  |                     |
|----------------------------------|---------------------|
| Turbine Flowmeters               | Telemetry Systems   |
| Vortex Sheddars                  | Event Recorders     |
| Positive Displacement Flowmeters | Vibration Monitors  |
| Watt-hour Meters                 | Totalizers          |
| V to F and F to V Converters     | Data Loggers        |
| Integrators                      | Velocity Detectors  |
| Tachometers                      | Magnetic Pickups    |
| Uninterruptable Power Supplies   | Motion Detectors    |
| Counters                         | Flowmeter Pickups   |
| Frequency Transmitters           | DC Contact Closures |
| Variable Speed Drives            |                     |

## TYPICAL INDUSTRIES

|                         |                   |
|-------------------------|-------------------|
| Chemical Plants         | Automotive Plants |
| Petroleum Refineries    | Aerospace         |
| Food Processing         | Pharmaceutical    |
| Pipelines               | Glass & Ceramics  |
| Utilities               | Metrology         |
| Water & Waste Treatment | Beverages         |
| Public Works            | Plastics          |
| Steel Mills             | Machinery         |
| Paper Mills             | Ordinance         |
| Textile Mills           | Computers         |

## SPECIFICATIONS

(Unless otherwise indicated, specifications are in  $\pm\%$  of Reading @ 25°C)

### READ MODE

Accuracy:  $\pm 0.005\% \pm \frac{1}{2}$  Least Significant Digit (LSD)  
 Sensitivity: Triggers down to 30mV, DC coupled (CPH Range triggers down to 100mV)  
 Maximum input voltage: 240 Volts peak-to-peak  
 Minimum pulse width: 2 microseconds  
 Input resistance: >1 Meg Ohm  
 Trigger Level Adjustment: x1 & x10 Attenuator plus continuous logarithmic control  
 Digital filtering: Push button selected rolling average of last five readings (Direct measurement of each cycle if not selected)

### SOURCE MODE

Accuracy:  $\pm 0.001\%$   
 Outputs: Square waves, adjustable from 50 mV to 14 V p-p, Zero based or Zero centered, 50%  $\pm$  1% Duty Cycle  
 Risettime: < 1 usec  
 Output impedance: 600 Ohms  
 Output adjust rate: 4 Digits/sec  
 Switched values: Two user adjustable "QUIK-CHEKS" (HI & LO) plus ADJUST position  
 Source Current: 8 mA max  
 Short Circuit Duration: Infinite  
 Optical output: LED calibrates Optical pickups  
 Voltage protection: Protected against accidental misconnection to 120 Volts AC/DC

### GENERAL

Internal crystal: <20 PPM/Year drift  
 Battery: Operates from one 9 Volt Battery (Alkaline supplied and recommended)  
 Battery Life: Minimum 50 hours READ Mode or with high impedance loads  
 Low Battery: "BAT" indication on LCD at 7 Volts nominal (approx. 10 hours left). Unit will shut down at 6 Volts to preserve memory  
 Memory: Retains output and QUIK-CHEK values, power on or off. Memory is preserved for 4 Hours without battery  
 Optional AC Adaptors: 120VAC and 240VAC, 50/60 Hz inputs  
 Slide Attenuator: Logarithmic for smooth input/output signal control  
 Temperature Effect:  $\pm 0.0001\%/^{\circ}\text{C}$  based on 25°C  $\pm 25^{\circ}$   
 Operating Temperature Range: Plus 5 to plus 140°F (minus 20 to plus 60°C)  
 Storage Temperature Range: minus 22 to plus 175°F (minus 30 to plus 80°C)  
 Relative Humidity: 10 to 90%, non-condensing  
 Warm up time: 5 seconds to rated accuracy  
 Overall Size: 6x3x2 inches (15.2x7.6x5.1 cm)  
 Weight: 14 oz. (0.4 kg.)

## RANGES

| RANGE | SOURCE              | RESOLUTION | RANGE | READ                | GATE TIME   | RESOLUTION |
|-------|---------------------|------------|-------|---------------------|-------------|------------|
| KHz   | 0.03 to 163.83 KHz  | 10 Hz      | KHz   | 0.01 to 199.99 KHz  | 0.1 seconds | 10 Hz      |
| KHz   | 0.003 to 16.383 KHz | 1 Hz       | KHz   | 0.001 to 19.999 KHz | 1 second    | 1 Hz       |
| Hz    | 0.3 to 1638.3 Hz    | 0.1 Hz     | Hz    | 0.1 to 1999.9 Hz    | 10 seconds  | 0.1 Hz     |
| CPM   | 0.3 to 1638.3 CPM   | 0.1 CPM    | CPM   | 4.0 to 1999.9 CPM   | Period x2   | 0.1 CPM    |
| CPH   | 3 to 16383 CPH      | 1 CPH      | CPH   | 120 to 19999 CPH    | Period x1   | 1 CPH      |

### WARRANTY

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from date of shipment.

Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option.

The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incidental or consequential damage.

### OTHER PRODUCTS

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal.

Contact our factory directly or your local stocking representative to order precise, low cost Milliamp Calibrators, Voltage Sources, Direct Thermocouple Sources, RTD Simulators and Frequency Sources. Altek also produces calibrators for custom ranges and unique applications.

Additional models and ranges are frequently added to the Altek instrument family to meet all of your critical calibration requirements.

### AVAILABLE FROM:

**ORDERING INFORMATION:**  
 MODEL 241 Frequency Calibrator  
 Carrying Case (included)  
 AC Adaptor: 120VAC  
 AC Adaptor: 240VAC

**Part No.**  
 241-6383  
 09-3782  
 28-0120  
 28-0240

# FREQUENCY SOURCE MODEL 40A

## ALTEK

- **DIRECT FREQUENCY OUTPUT**  
40 Precise steps 0.5 Hz to 60 KHz
- **TUNING FORK CRYSTAL**  
0.0008% accuracy
- **LABORATORY STABILITY**  
 $\pm 0.001\%$  per deg C
- **ZERO BASED AND ZERO CENTER**  
Switch selected outputs
- **POCKET SIZED**  
1 Year battery life

ALTEK Model 40A Frequency Sources provide 40 precise frequencies from 0.5 to 60,000 Hertz. Output is a square wave\* of 15 volt peak-to-peak amplitude which can be set to any lower value with a built-in attenuator. Switch selects zero based or zero center outputs for standard or zero crossing inputs.

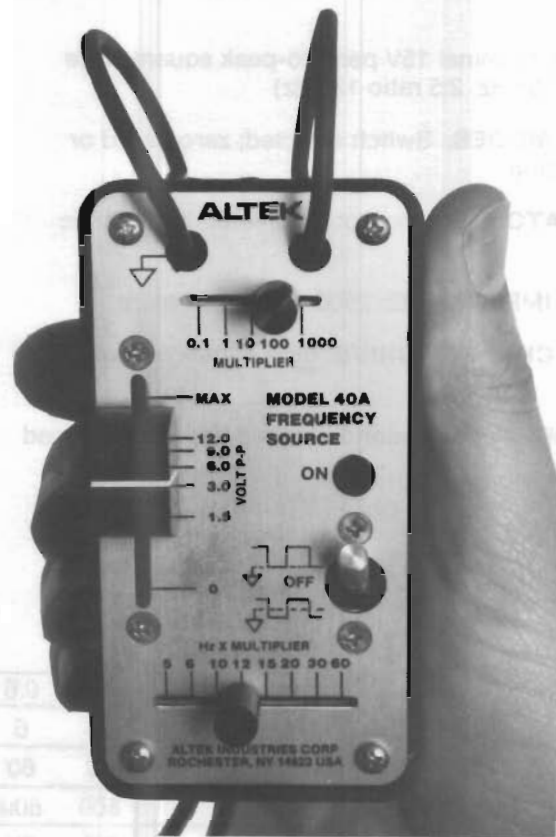
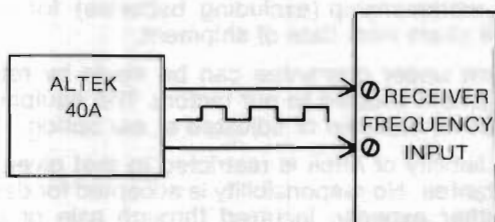
The ALTEK Model 40A checks and calibrates the electronics of turbine meters, vortex shedding meters, positive displacement meters, oscilloscopes, electronic counters, tachometers and many other frequency input devices. LED flashes to calibrate optical and fiber optic devices.

Frequency Accuracy is  $\pm 8$  parts per million. Long term stability is  $\pm 3$  parts per million per year.

Instant turn-on allows long life from the two 9 volt alkaline batteries (200 hours continuous). Frequency is adjusted with the 8 position frequency selector switch and a 5 position range multiplier switch.

The low cost ALTEK Model 40A is a complete, compact source for checkout and calibration of all frequency instruments in the field, shop, lab and control room.

\*20KHz = 1:3 Ratio  
12KHz = 2:5 Ratio



## OPERATING INSTRUCTIONS

Connect the ALTEK Model 40A to the frequency input of the device to be checked or calibrated. Select the frequency and multiplier for the initial frequency desired. Turn the power switch "on" and observe the glow in the light emitting diode (LED).

If the diode glows, the battery is at a sufficient level to provide proper operation. At low frequencies, the LED flashes in synchronism with the selected frequency. Adjust the attenuator for proper level. Check at all desired frequencies, turn off and disconnect the Model 40A.

## ALTEK INDUSTRIES CORP.

210 Commerce Drive  
Rochester, New York 14623 U.S.A.  
(716) 334-3720  
FAX: (716) 334-6673



## SPECIFICATIONS:

**ACCURACY:**  $\pm 0.0008\%$  (8 parts per million)

**FREQUENCIES:** 5, 6, 10, 12, 15, 20, 30 and 60 Hz times multiplier

**MULTIPLIER:** 0.1, 1, 10, 100 and 1000 times frequency scale

**OUTPUT:** Nominal 15V peak-to-peak square wave (1:3 ratio 20KHz, 2:5 ratio 12KHz)

**OUTPUT MODES:** Switch selected; zero based or zero crossing

**ATTENUATOR:** Sliding potentiometer, logarithmic taper

**OUTPUT IMPEDANCE:** 2500 ohms maximum

**OUTPUT CURRENT DRIVE:** 6mA at max output voltage

**RISE TIME:** 1 microsecond nominal into resistive load

**OPERATING AMBIENT TEMPERATURE:** 14 to 158° F (-10 to + 70° C)

**STORAGE TEMPERATURE:** -22 to +185° F (-30 to +85° C)

**AMBIENT TEMPERATURE EFFECT:**  $\pm 0.001\%/^{\circ}\text{C}$

**BATTERY:** 2 x 9-volt Alkaline

**BATTERY LIFE:** 200 hours of operation

**BATTERY INDICATION:** LED flashes with frequency if batteries OK

**SIZE:** 2-1/8 x 4 x 2-1/4 inches (54x102x55mm)

**WEIGHT:** 7 oz. (0.2 kg)

**OPTIONAL CARRYING CASE:** Zippered with belt loop

| SWITCH<br>POSITION<br>MULTIPLIER | DESIRED FREQUENCY IN Hz         |     |     |      |      |     |     |     |
|----------------------------------|---------------------------------|-----|-----|------|------|-----|-----|-----|
|                                  | 0.1                             | 0.5 | 0.6 | 1    | 1.2  | 1.5 | 2   | 3   |
| 1                                | 5                               | 6   | 10  | 12   | 15   | 20  | 30  | 60  |
| 10                               | 50                              | 60  | 100 | 120  | 150  | 200 | 300 | 600 |
| 100                              | 500                             | 600 | 1K  | 1.2K | 1.5K | 2K  | 3K  | 6K  |
| 1000                             | 5K                              | 6K  | 10K | 12K  | 15K  | 20K | 30K | 60K |
|                                  | 5                               | 6   | 10  | 12   | 15   | 20  | 30  | 60  |
|                                  | SWITCH POSITION Hz X MULTIPLIER |     |     |      |      |     |     |     |

## ORDERING INFORMATION:

**MODEL 40A:** 40A-0560

Optional Carrying Case 09-3781

## OTHER PRODUCTS

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal. Consult our factory directly or your local supplier to order precise, low cost Milliamp, RTD, Thermocouple, Voltage and Frequency Calibrators. Additional models and ranges are frequently added to the Altek instrument family to meet all of your critical calibration requirements.

## WARRANTY

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from date of shipment.

Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option.

The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incidental or consequential damage.

## AVAILABLE FROM:

# ALTEK

## PRESSURE INDICATOR MODEL 620

- **INTRINSICALLY SAFE**  
FM Approved
- **CHOOSE ONE OF THREE RANGES**  
0 to 20 psig  
0 to 100 psig  
0 to 200 inches of water
- **±0.25% ACCURACY**
- **3 1/2-DIGIT LIQUID CRYSTAL DISPLAY**  
0.01 psig resolution
- **9V BATTERY OPERATED**  
Automatic power shutoff conserves battery life



### GENERAL DESCRIPTION

Accurately test gauges, pneumatic devices and systems with ALTEK's Model 620 digital pressure indicator. This pocket-sized instrument replaces delicate bellows-type receiver gauges used in the 15 psi range and bulky 4 1/2- and 6-inch bourdon tube gauges used in the 100 psi range. Combine with ALTEK's Model 628 hand-actuated pressure pump to create a convenient, lightweight pressure source and indicator for pressure loop calibration.

Rugged design plus FM approval (when used with specified battery) let you use the Model 620 with confidence anywhere in your plant, including hazardous locations. The highly reliable solid state sensor withstands two times full-scale overpressure on all ranges, replacing delicate mechanical movements susceptible to damage and phosphor bronze bellows that can be sprung.

Calibrated accuracy is  $\pm 0.25\%$  of full scale. The easy-to-read liquid crystal display provides exceptional 0.01 psig resolution, five times better than that of typical 6-inch, 15 psig test gauge.

Choose your Model 620 in one of three ranges: 0 to 20 or 0 to 100 psig and 0 to 200 inches of water. A table on the back of each instrument provides units translation. Connection to the pressure source is through a 1/8"-27 NPT female bulkhead fitting at the top of the case.

The Model 620 operates up to 60 hours from a single 9V carbon-zinc battery (Eveready #216). An automatic shut-off feature turns the unit off after four minutes of continuous use, conserving battery life and preventing accidental discharge. Move an internal jumper to override the automatic shut-off for extended use.

"Toolbox tough," Altek's Model 620 is housed in an impact-resistant, ABS plastic case weighing just 9 ounces and small enough to fit into your pocket.

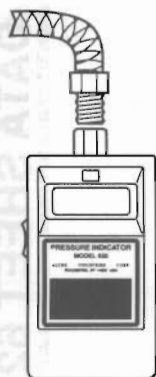
### ALTEK INDUSTRIES CORP

210 Commerce Drive  
Rochester, New York 14623 U.S.A.  
(716) 334-3720  
Fax: (716) 334-6673

# OPERATING INSTRUCTIONS

## GENERAL

### CONNECTIONS



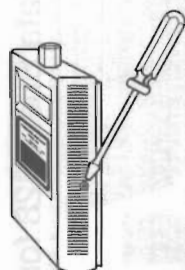
Connect the Model 620 to the line or device under test via the pressure input port at the top of the case. This is a 1/8"-27 NPT female bulkhead fitting to which the external air supply fittings are connected.

To install the fittings,

- 1) wrap the fitting threads with two turns of Teflon tape
- 2) tighten the fitting down.

**Note:** Use a 5/8" open-end wrench on the input port to prevent it from rotating while the supply fitting is being tightened.

### ZERO ADJUSTMENT



When the 620 is switched on, the display should show all zeroes with no pressure applied. If not, this can easily be corrected using the zero adjustment pot, which is accessed through an opening on the right-hand side of the case (Fig. 1). A 1/8" flat screwdriver or miniature pot adjustment tool should be used. Adjust the pot until all positions in the display read "0."

### OVER RANGE



If an overrange condition exists, the numeral "1" is displayed as the first digit and the remaining digits are blanked.

### AUTOMATIC POWER SHUT-OFF

The 620 automatically powers down after four minutes of operation to maximize battery life. To override this feature, install an internal jumper in the TST position, as shown in Fig. 2.

### CHANGING BATTERY



DO NOT change the battery in hazardous location. Use *only* an Eveready No. 216 9V carbon-zinc battery.

Low battery is indicated by a horizontal bar above the negative sign position on the main display. Approximately two hours of operation remain before the display readings become unreliable. Turn the 620 off, insert a small screwdriver into the slot on top of the battery cover, and gently pry up the cover. The battery is fastened to a 9V battery clip and is easily removed.

### WARNING!



DO NOT open the instrument case or battery compartment in a hazardous location for *any* reason.

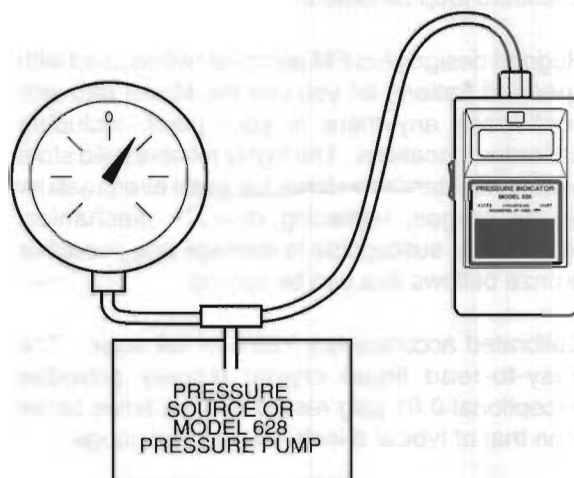
Field service procedures for the Model 620 are limited to battery replacement, zero adjustment of the display, and periodic recalibration. Units requiring service beyond the scope of the following procedures should be returned to ALTEK for service. Unauthorized repair or replacement of components may impair intrinsic safety and void Factory Mutual Research approval.

## PRESSURE MEASUREMENT

### MEASURE

- 1) Connect the Model 620 to the device being calibrated or checked
- 2) Turn the power on
- 3) The large, 3 1/2-digit LCD reads out the value of the pressure being input. The small label above the display indicates the 620's full-scale pressure range and engineering units, i.e., psig or inches H<sub>2</sub>O.

**Hint:** To translate the measured value into other engineering units, refer to the cross-reference table on the back of the instrument case.





## OPERATING INSTRUCTIONS

### CALIBRATION

Each Model 620 is factory calibrated. Should recalibration be necessary, use equipment of sufficient accuracy.

#### Equipment needed:

Pressure source, 0 to 20 psi or 0 to 100 psi (whichever is applicable), with 0.1% full-scale accuracy, Phillips screwdriver and small adjustment screwdriver.

- 1) Disconnect all tubing from pressure input port.
- 2) From the rear of the case, remove the four screws holding the instrument cover to the case.
- 3) Remove cover. The power ON/OFF slide knob will separate from the case. Place it in a safe location. Use the internal power switch to turn the unit on.
- 4) Connect pressure source to the pressure input port at the top of the case. If a "T" fitting is used at the input port, seal the unused outlet.

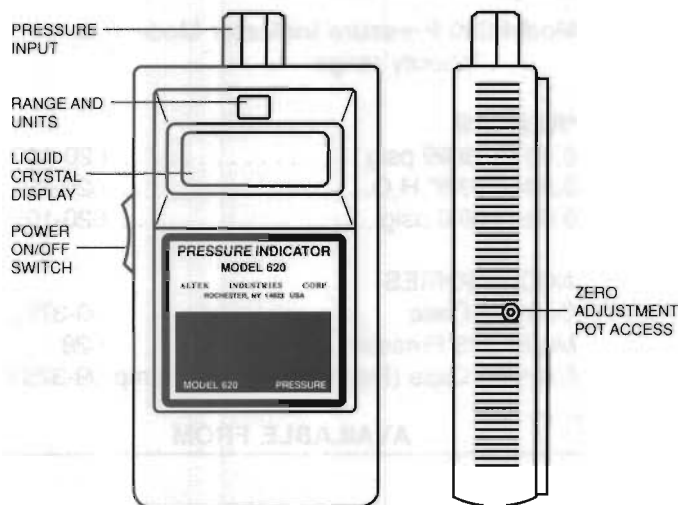


Figure 1

- 5) With zero pressure applied, adjust zero pot until the display reads "0."
- 6) Apply full-scale pressure. Adjust span pot until full-scale reading appears on display. For 20 psi or 200" H<sub>2</sub>O models, use 90% full-scale settings of 18 psi and 180" H<sub>2</sub>O.
- 7) Reduce pressure to 50% of full scale. Use span adjustment to equalize the error between 100% (90%) and 50% pressure inputs. The error should be less than  $\pm 6$  counts for 20 psi and 200 inches of water models and  $\pm 3$  counts 100 psi models. If this tolerance cannot be achieved, return the instrument to the factory.
- 8) Replace external power slide knob. Replace case cover and securely tighten screws.

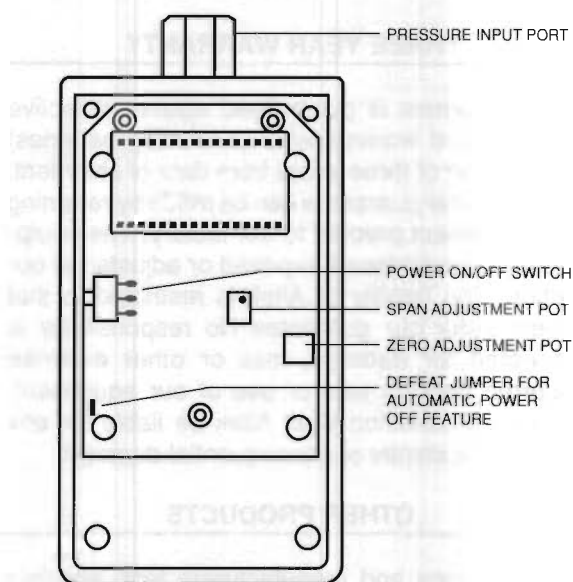


Figure 2

### NOTICE OF HAZARDOUS LOCATION CLASSIFICATION

The Model 620 Pressure Indicator, when used with Eveready Number 216 Battery, is certified for use as follows:

Factory Mutual Research:



Intrinsically safe for Class I, Division 1, Groups A, B, C and D; Class II, Division 1, Groups E, F and G; and Class III hazardous locations.

Nonincendive for Class I, Division 2, Groups A, B, C and D; Class II Division 2, Groups F and G; and Class III hazardous locations.

**CAUTION:** The unit must never be opened in hazardous locations. Batteries can only be changed in a non-hazardous location. Substitution of components may impair approval.

**ALTEK INDUSTRIES CORP**  
Rochester, New York 14623 USA

## SPECIFICATIONS

(Unless otherwise specified, specifications are in % of Span at 25°C ± 1°C (77°F ± 2°F))

### INPUT RANGES

0 to 19.99 psig

0 to 100.0 psig

0 to 199.9" H<sub>2</sub>O

CALIBRATED ACCURACY: ±0.25% of full scale

MEDIA COMPATIBILITY: Non-conductive, non-corrosive, instrument grade clean air or inert gas

PRESSURE CONNECTION: 1/8"-27 NPT female fitting

OVERPRESSURE RATING: Two times full-scale pressure on all ranges

FM APPROVAL: Certified as follows, when used with Eveready No. 216 battery: Intrinsically safe for Class I, Div. 1, Groups A, B, C, and D; Class II, Div. 1, Groups E, F, & G; Class III Hazardous Locations. Non-incendive for Class I, Div. 2, Groups A, B, C, & D; Class II, Div. 2, Groups F & G; and Class III Hazardous Locations.

DISPLAY: 3 1/2-digit LCD, resolution to 0.01 psig

BATTERY: One 9V NEDA 1604, carbon-zinc (Eveready No. 216 for FM approvals). 60 hours nominal use for 33% duty cycle (8 hours "on," 16 "off").

OPERATING CURRENT: 8 mA max.

POWER-OFF CURRENT: 10 µA max.

LOW BATTERY INDICATION: Horizontal bar above negative sign position in display

OPERATING TEMPERATURE: -9 to +50°C (15 to 122°F)

TEMPERATURE EFFECT:

10 to 50°C (50 to 122°F): ±0.036% of full scale per °C (0.02% f.s./°F)

0 to 10°C (32 to 50°F): ±0.054% of full scale per °C (0.03% f.s./°F)

STORAGE TEMPERATURE: -40 to +83°C (-40 to +180°F)

CASE CONSTRUCTION: Molded, impact-resistant ABS plastic

OVERALL SIZE: 150 x 80 x 25 mm (6 x 3.13 x 1")

WEIGHT: 0.25 kg (9 oz.)

### THREE YEAR WARRANTY

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from date of shipment. Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option. The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incidental or consequential damage.

### OTHER PRODUCTS

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal. Consult our factory directly or contact your local stocking representative to order precise, low cost Milliamp Calibrators, Voltage Sources, Direct Thermocouple Sources, RTD Simulators and Frequency Sources. Altek also produces calibrators for custom ranges and unique applications. Additional models and ranges are frequently added to the Altek instrument family to meet all of your critical calibration requirements. Altek products are made in the USA.

### ORDERING INFORMATION

Model 620 Pressure Indicator Model 620 - ...  
\*specify range

#### \*RANGES

0.00 to 19.99 psig ..... 620-100  
0.0 to 199.9" H<sub>2</sub>O ..... 620-101  
0.0 to 100.0 psig ..... 620-102

#### ACCESSORIES

Carrying Case ..... 09-3782  
Model 628 Pressure Pump ..... 628  
Carrying Case (Holds Indicator & Pump) 09-3783

### AVAILABLE FROM

# ALTEK

## PRECISION PRESSURE PUMP MODEL 628

- **PORTABLE PRESSURE SOURCE**  
Generates from -2 to 100 psig
- **COARSE AND FINE ADJUSTMENTS**  
Provide resolution to 0.001 psig
- **DUAL OUTPUT PORTS**  
Simultaneous connection to two devices
- **CONVENIENT, ONE-HANDED OPERATION**  
Functions at any angle



### GENERAL DESCRIPTION

Generate pressure where you need it with Altek's Model 628 Precision Pressure Pump. Generate values from -2 to 100 psig, with a fine adjustment vernier providing output resolution to 0.001 psig. Use it independently or in conjunction with ALTEK's Model 620 pressure indicator, forming a convenient source/indicator in the 20 psig or 100 psig range.

Dual output ports allow simultaneous pressure application to two devices. For example, connect one port to the Model 620—providing digital verification of the generated pressure—and the second port to the device being checked or calibrated.

Pressure connections are made through two 1/8" NPT internally threaded fittings. Compatible media are any non-conductive, non-corrosive, instrument-grade clean air or inert gas.

The pump's small size and squeeze-action mechanism permit easy, one-handed operation at any angle. Although the unit is lightweight (less than two pounds), it is ruggedly constructed to withstand typical field use. The pump body and piston are machined brass, and the valve stem, piston rod, and handles are stainless steel. Model 628's simple design and quality construction ensure a long service life with virtually no maintenance.

### SPECIFICATIONS

**OUTPUT RANGE:** -2 to 100 psig

**RESOLUTION:** 0.001 psig

**PRESSURE CONNECTIONS**

Primary Port: 1/8"-27 NPT

Auxiliary Port: 1/8"-27 NPT

**WEIGHT:** 0.87 kg (1.9 lb.)

**MEDIA COMPATIBILITY:** Non-conductive, non-corrosive, instrument-grade clean air or inert gas

**CONSTRUCTION:** Machined brass pump body, piston; stainless steel piston rod, handles

#### ALTEK INDUSTRIES CORP

210 Commerce Drive  
Rochester, New York 14623 U.S.A.

(716) 334-3720

Fax: (716) 334-6673



## OPERATING INSTRUCTIONS

**IMPORTANT:** Read all operating instructions and general operating information *before* beginning any test procedures.

### PRODUCING POSITIVE PRESSURE



- 1) Connect one of the Model 628's ports to the instrument to be calibrated or checked. Use small-diameter tubing as short in length as possible (this will maximize the pressure adjustment range). An auxiliary port is provided for simultaneous output to a second device, e.g., application of pressure to an instrument or system under test and to a Model 620 to measure the actual pressure output. If the auxiliary port is not used, it should be securely plugged.
- 2) Set the brass fine pressure adjustment knob to the mid-travel position as indicated by the line cast into the pump body.
- 3) Turn the discharge knob fully clockwise. Do not overtighten.
- 4) Squeeze the actuating levers to generate pressure. At pressures above 150 psig the levers should be squeezed harder and more quickly at the end of the stroke. Additional force is required to open the discharge valve due to higher line pressure.
- 5) Use the discharge and fine pressure knobs to adjust pressure to the desired level.

### PRODUCING NEGATIVE PRESSURE



- 1) Perform Step 1 as described above.
- 2) Turn the brass fine pressure adjustment fully clockwise until resistance is felt. Do not overtighten.
- 3) Turn the discharge knob fully clockwise. Do not overtighten.
- 4) Turn the fine pressure adjustment counter-clockwise to generate the desired negative pressure (to -2 psig).

### WARNING



Even nominal pressure values can generate extreme force if fitting or tubing failure occurs due to improper installation or usage. Since the Model 628 is capable of generating pressures over 100 psig, it is imperative that all pressure connections and test procedures be done by qualified service personnel, according to standard engineering practices, to prevent possible personal injury or equipment damage.

## GENERAL OPERATING INFORMATION

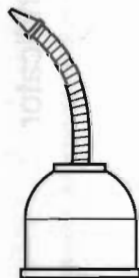
### TEMPERATURE CONSIDERATIONS



Since the pressure change of a contained volume of gas is directly proportional to absolute temperature, temperature control is critical when using the Model 628 with any high-resolution measuring device. Tubing should be kept away from heat sources (i.e., lamps, operating electronic equipment, excessive hand contact, etc.) as well as from heat-dissipating structures (i.e., open windows, air conditioning vents, ventilation ducts, etc.) to minimize temperature variations that might induce measurement error.

Air is compressed when the Model 628's actuating levers are squeezed. This compression causes some heating of the air as it is forced into the system. Consequently, a noticeable decrease in pressure—caused by the cooling of the newly compressed air—may occur immediately after cessation of pumping.

### LUBRICATION



The Model 628 is lubricated at the factory and under normal operating conditions should not require additional lubrication. If lubrication is required, invert the pump and apply two drops of a light-grade machine oil to the piston rod near the base of the pump body. Do not over-oil.

### ONE YEAR WARRANTY

This equipment is guaranteed against defective material and workmanship for a period of one year from date of shipment. Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option. The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incidental or consequential damage. No pump will be accepted for service unless all process materials have been completely removed from all components by the customer. Contaminated pumps will be returned to the customer for proper cleaning.

### OTHER PRODUCTS

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal. Consult our factory directly or contact your local stocking representative to order precise, low cost Milliamp Calibrators, Voltage Sources, Direct Thermocouple Sources, RTD Simulators and Frequency Sources. Altek also produces calibrators for custom ranges and unique applications. Additional models and ranges are frequently added to the Altek instrument family to meet all of your critical calibration requirements. Altek products are made in the USA.

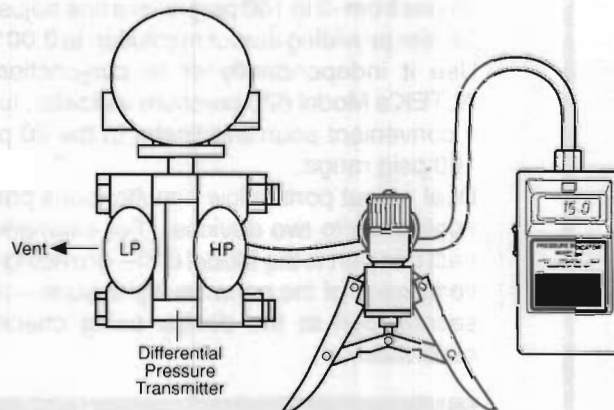
### LEAK PREVENTION AND DETECTION



In order to obtain maximum pressure indication stability, leaks must be avoided. It is strongly recommended that either Teflon® tape or commercial pipe sealant be used at all tapered fittings and connections. If Teflon® tape is used, care must be taken that the proper amount is applied. Excessive tape may fray and cause plugging of relief valves, orifices, nozzles, etc. Overuse of pipe sealant may cause similar problems.

External equipment should also be checked carefully for leaks. Process connections, flange bolts, and vents must be tightly closed. Defective gaskets, leaking valves, and damaged diaphragms are all potential sources of leaks.

For detection of very small system leaks, the traditional soap bubble method may not be sufficient. Halogen leak detection devices may be required when using highly sensitive pressure calibration equipment.



### ORDERING INFORMATION

Model 628 Precision Pressure Pump

Model 628

### OPTIONAL ACCESSORIES

Carrying Case

09-3783

Holds Model 628 Pump and Model 620 Pressure Indicator

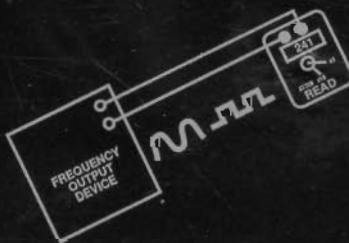
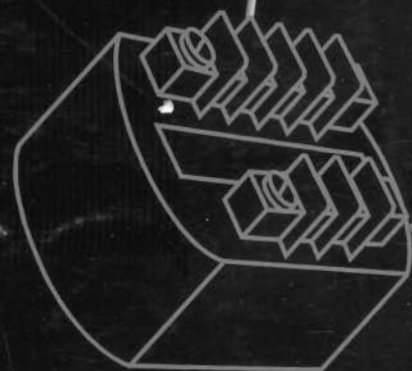
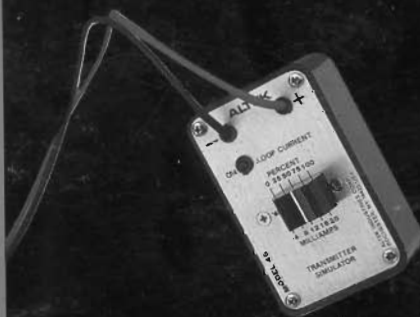
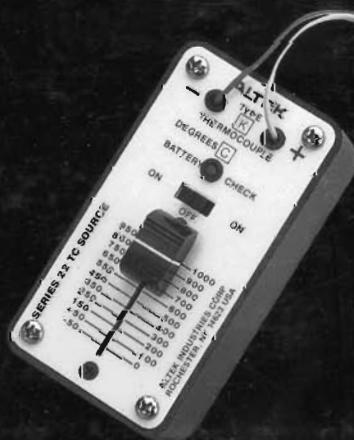
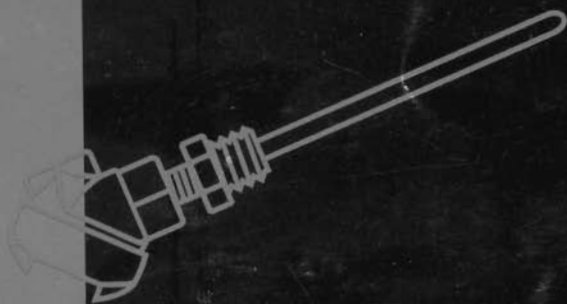
### AVAILABLE FROM:

# ALTEK

## ALPHA

CONTROLS AND INSTRUMENTATION

361 Steelcase Rd. West, Unit 5 & 6, Markham, Ontario Canada L3R 3V8  
Tel: (905) 477-2133 Fax: (905) 477-4219 Toll Free: (800) 567-8686



ALTEK INDUSTRIES CORP

210 Commerce Drive  
Rochester, NY 14623  
(716) 334-3720  
Fax (716) 334-6673